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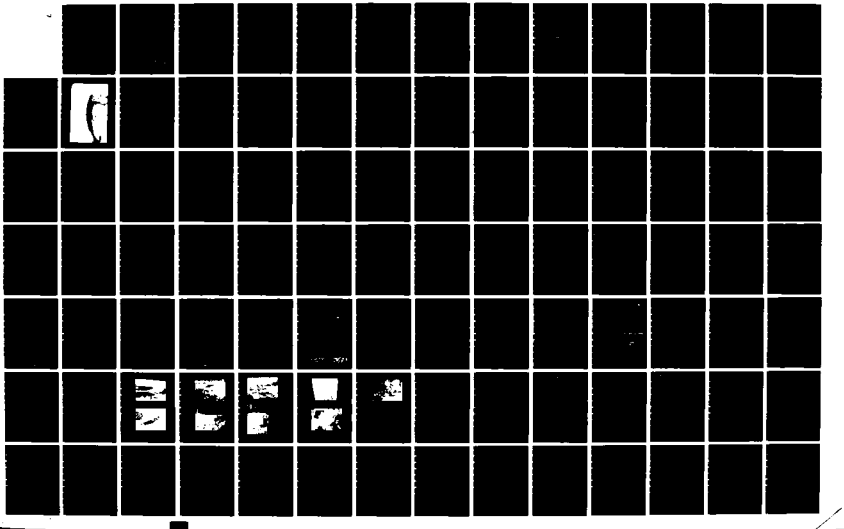

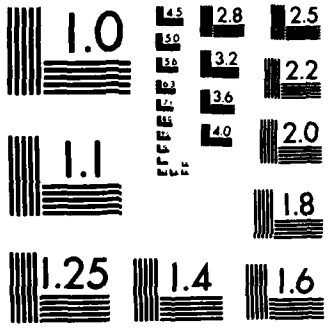

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HOUSATONIC RIVER BASIN

DANBURY, CONNECTICUT

UPPER KOHANZA DAM
CT 00062

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MAY 1981

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Housatonic River Basin
Danbury, Conn.
Upper Kohanza Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The original Upper Kohanza Dam, an earthfill embankment constructed in 1866 for the purpose of water supply, failed in 1869. Shortly thereafter, the dam was rebuilt on the same axis and has continued in service to the present date without incident. The dam is curved in plan and approx. 600 ft. long, 31 ft. high, and 18 ft. wide at the crest. The upstream face is riprapped and has a 3H:1V slope. The downstream face has a 2H;1V slope and is protected by thick grass cover. At the left abutment of the dam is a 12 ft. wide uncontrolled spillway defined by two parallel masonry walls that extend the entire length of the 110 ft. long channel.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED

JUL 23 1981

Honorable William A. O'Neill
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor O'Neill:

Inclosed is a copy of the Upper Kohanza Dam (CT-00062) Phase I Inspection Report, prepared under the National Program for Inspection of Non-Federal Dams. This report is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. I approve the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is vitally important.

Copies of this report have been forwarded to the Department of Environmental Protection, and to the owner, City of Danbury, Danbury, CT. Copies will be available to the public in thirty days.

I wish to thank you and the Department of Environmental Protection for your cooperation in this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

Incl
As stated

UPPER KOHANZA DAM

CT 00062

HOUSATONIC RIVER BASIN

DANBURY, CONNECTICUT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: CT 00062
Name of Dam: Upper Kohanza Dam
City: Danbury
County and State: Fairfield, Connecticut
Stream: Kohanza Brook
Dates of Inspection: February 3 and 19, 1981

BRIEF ASSESSMENT

The original Upper Kohanza Dam, an earthfill embankment constructed in 1866 for the purpose of water supply, failed in 1869. Shortly thereafter, the dam was rebuilt on the same axis and has continued in service to the present date without incident. The dam is curved in plan and approximately 600 feet long, 31 feet high, and 18 feet wide at the crest. The upstream face is riprapped and has a 3H:1V slope. The downstream face has a 2H:1V slope and is protected by thick grass cover. At the left abutment of the dam is a 12-foot-wide uncontrolled spillway defined by two parallel masonry walls that extend the entire length of the 110-foot-long channel. Discharge from the spillway is channeled past the toe of the dam and returned to Kohanza Brook. At the toe of the dam, approximately 70 feet from the spillway, is a small gatehouse with a hand-operated control valve for operation of the 18-inch-diameter, cast iron, outlet conduit. This conduit passes through the dam and is the only outlet from the reservoir.

Visual inspection of the dam and spillway indicated that the structure is in poor condition and in need of repairs and further study. The riprap slope protection on the upstream face of the dam has been displaced in local areas with erosion of the underlying soils in progress. The crest of the dam is not very level; though at any given cross section, the high

point is close to the reported crest elevation. Large tree stumps and old root systems are visible on the dam above the normal high water line. Near the downstream toe of the dam and to the right of center (south side) an area of potentially significant seepage was identified. The spillway channel was noticeably obstructed by numerous cobbles, boulders, trees, and other debris. The two masonry spillway side channel walls are nearly gone, and many of the stone blocks have fallen into the spillway channel. Near the discharge end of the spillway channel, there is some limited erosion of the toe of the dam.

The Upper Kohanza Dam has a top of dam storage capacity of 420 acre-feet (ac-ft) and is approximately 31 feet in height. Since the dam is within the Corps' criteria for the small size category for storage (50 to 1,000 ac-ft) and height (25 to 40 feet), the dam is considered to be small in size. The failure of the dam could cause the loss of a few lives; therefore, the dam has been classified as having a SIGNIFICANT hazard potential. In accordance with the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", the size classification (SMALL), and the hazard classification (SIGNIFICANT) the test flood will be between a 100-year frequency flood and one-half the Probable Maximum Flood (1/2 PMF). Since the failure of the upper dam may effect the lower dam (see Appendix B, pgs. B-14 & B-15), thus increasing the potential impact, the larger test flood was selected. As a result, the peak inflow to the pond will be 1,400 cubic feet per second per square mile (cfs/sq. mi.) or 575 cubic feet per second (cfs) and the peak outflow is 240 cfs. The capacity of the spillway, with the water surface at the top of the dam, is 525 cfs or 219 percent of the routed test flood outflow. As a result, the dam will not be overtopped.

It is recommended that the owner retain the services of a qualified registered professional engineer to investigate the areas where evidence of seepage was found, determine if piping has occurred along the outlet conduit, evaluate the effect of spillway discharge on the toe of the dam, assess the operating condition of the valve on the outlet conduit, and develop a program for the repair of the spillway and eroded areas on the embankment.

The recommendations and remedial measures outlined above and discussed in Section 7 should be instituted within one (1) year of the owner's receipt of this report.

Reynold A. Hokenson, P.E.

Reynold A. Hokenson, P.E.
Project Manager
International Engineering Company, Inc.

This Phase I Inspection Report on Upper Kohanza Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

ARAMAST MAHTESIAN, MEMBER
Geotechmical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, CHAIRMAN
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm

event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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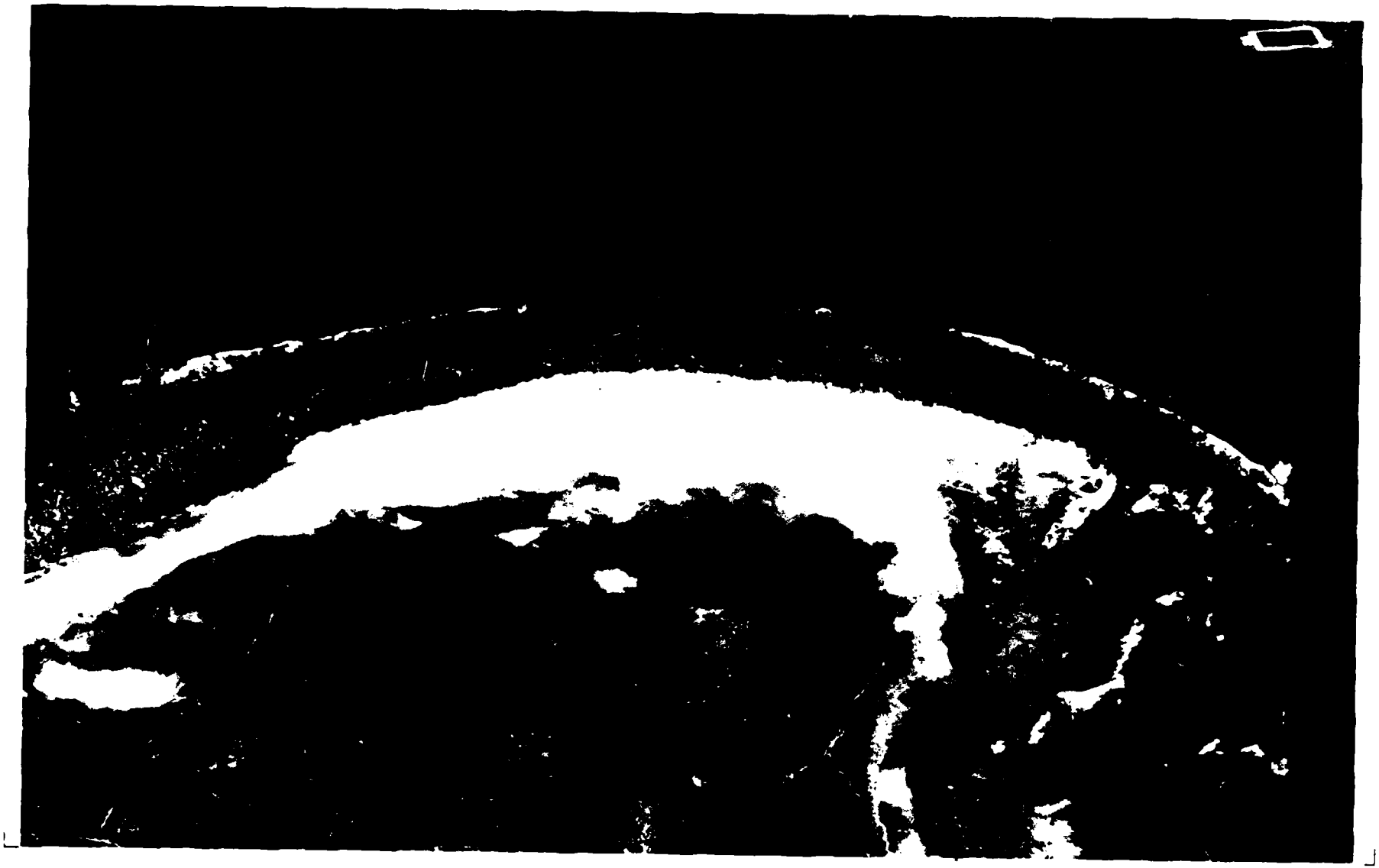
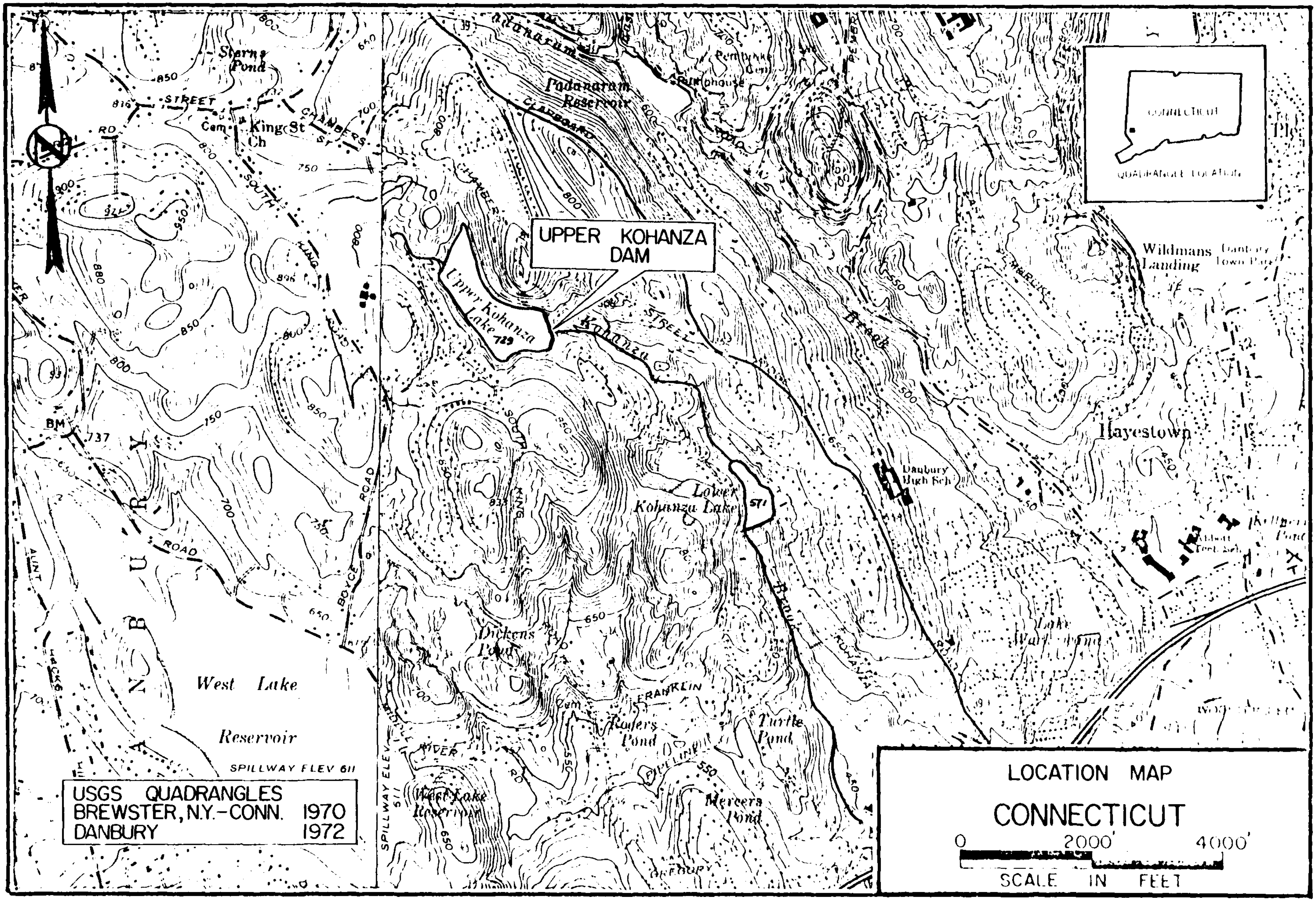
APPENDIXES



OVERVIEW PHOTO-UPPER KOHANZA DAM
FEBRUARY 3, 1981


UPPER KOHANZA DAM
Upper Kohanza Lake 729
Lower Kohanza Lake 571
Padanaram Reservoir
Stearns Pond
King St Ch
Dickens Pond
Rogers Pond
Turtle Pond
Mercers Pond
West Lake Reservoir
Wildmans Landing
Hayestown
Danbury High Sch
SPILLWAY ELEV 611
LOCATION MAP
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USGS QUADRANGLES
BREWSTER, N.Y.-CONN. 1970
DANBURY 1972

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

UPPER KOHANZA DAM

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority — Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England region. International Engineering Company, Inc., has been retained by the Corps' New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to International Engineering Company in a letter dated November 5, 1980, from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-81-C-0015 has been designated by the Corps for this work.

b. Purpose of Inspection Program — The purposes of the program are to:

(1) Perform technical inspections and evaluations of non-Federal dams to identify conditions requiring correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for non-Federal dams.

(3) Update, verify, and complete the National Inventory of Dams.

c. Scope of Inspection Program — The scope of this Phase I Inspection Report includes:

(1) Gathering, reviewing, and presenting all available data as can be obtained from the owners, previous owners, the state, and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments, and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The purpose of the inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location — The dam is located on Kohanza Brook in the City of Danbury, Fairfield County, Connecticut, approximately 3 miles upstream from the confluence with Still River which is a tributary of the Housatonic River. The location of the dam is defined by latitude N41°25.3' and longitude W73°29.4' on the Danbury, Connecticut, USGS Quadrangle Map.

b. Description of Dam and Appurtenances — The facility consists of a 600-foot-long, 31-foot-high earthfill embankment that is curved in plan, a rock-lined spillway at the left abutment of the dam, and a valve-controlled, 18-inch-diameter, cast iron, low level outlet conduit passing through the dam approximately 70 feet from the spillway (Appendix B,

Sheet B-1). The dam embankment is approximately 18 feet wide at the crest and the upstream and downstream slopes have inclinations of 3H:1V and 2H:1V respectively. The upstream slope is entirely covered with riprap, while the downstream slope is overgrown with grass and brush.

The spillway structure is a 12-foot-wide channel with an uncontrolled stone crest. The upstream section of the channel is 50 feet long and level (El. 729 NGVD; Note: All elevations are referenced to the National Geodetic Vertical Datum.) The downstream section is 60 feet long and steeply sloped. The channel directs the discharge to a point approximately 75 feet beyond the toe of the dam. The spillway sidewalls are masonry and extend the entire length of the channel.

The low level outlet consists of an 18-inch-diameter cast iron pipe (invert El. 704 NGVD) that passes through the dam. Flow through the conduit is controlled using a hand-operated valve found in a small masonry house located on the downstream toe of the dam. The outlet of the pipe is approximately 10 feet downstream of the valve control stem.

c. Size Classification - SMALL — The size classification is based on the height of the dam above the natural streambed or the maximum storage potential of the reservoir, which is defined by a pool at the level of the dam crest. The size classification of the dam is determined by the criteria that yields the larger size category. Upper Kohanza Dam has a maximum potential storage capacity of 420 ac-ft, which is within the established limits for the small size category (50 ac-ft to 1,000 ac-ft), and the height of the dam (31 feet) is also within the limits for the small size category (25 feet to 40 feet). Thus, the dam is considered to be SMALL in size.

d. Hazard Classification - SIGNIFICANT — The hazard classification is based on the estimated loss of life and the anticipated property damage due to a dam breach when the water surface within the impoundment is at the crest of the dam. The failure of Upper Kohanza Dam would cause the water level in Kohanza Brook to rise from 0.7 feet before

the failure at a prefailure outflow of 525 cfs to 7.6 feet after the failure in the vicinty of the first downstream home (1,700 feet from the dam). This home straddles Kohanza Brook and the first floor elevation is approximately 7 feet above the water surface. As a result, the first floor would be flooded to a depth of at least 0.6 feet. Consequently, the flood would damage 1 home and the bridge culvert at Zinn Road and could potentially cause the loss of a few lives. There is also a potential for the lower dam to sustain some structural damage after it is overtopped by the flood wave. Therefore, the Upper Kohanza Dam has been classified as having a SIGNIFICANT hazard potential.

e. Ownership — City of Danbury
Public Utilities
155 Deerhill Avenue
Danbury, Connecticut 06810

f. Operator — Daniel Garamella
Director of Public Works
(203) 799-4537

g. Purpose — The Upper Kohanza Lake Reservoir is used in conjunction with the Lower Kohanza Lake Reservoir as a supplement to the Danbury public water supply. Water flows from the Upper to the Lower Reservoir via Kohanza Brook. From there, it is pumped to West Lake Reservoir where it enters the public water supply system.

h. Design and Construction History — The original dam was reportedly constructed in 1866 by the Town of Danbury to create a water supply reservoir. In February 1869, the dam was breached, resulting in the destruction of the Lower Kohanza Dam, three bridges, and several privately owned structures. According to the available records, the restoration of both dams began immediately after the incident. No technical information was available regarding the original or the reconstructed Upper Kohanza Dam.

i. Normal Operational Procedures — The water level in the reservoir is normally maintained at the spillway crest (El. 729 NGVD).

During dry periods, discharges from the reservoir are made via the 18-inch-diameter outlet conduit.

1.3 PERTINENT DATA

a. Drainage Area — The drainage area consists of 0.41 square miles (sq. mi.) of rolling to mountainous terrain that has been developed as residential property.

b. Discharge at the Dam Site — Discharges at the dam site normally occur through the spillway but may also pass through the 18-inch-diameter outlet conduit.

(1) When the water surface is at the top of the dam, the 18-inch outlet conduit (invert elevation 704) will pass 13 cfs.

(2) The maximum known flood at the dam site partially breached the original dam in February 1869.

(3) Ungated capacity of the spillway is 525 cfs at elevation 735.

(4) Ungated spillway capacity at test flood elevation (732.8) is 240 cfs.

(5) Gated spillway capacity at normal pool elevation - N/A.

(6) Gated spillway capacity at test flood elevation - N/A.

(7) Total spillway capacity at test flood (elevation 732.8) is 240 cfs.

(8) Total project discharge at top of dam (elevation 735) is 525 cfs.

(9) Total project discharge at test flood (elevation 732.8) is 240 cfs.

c. Elevations (feet above NGVD)

(1)	Streambed at toe of dam	704
(2)	Bottom of cutoff	Unknown
(3)	Maximum tailwater	Unknown
(4)	Normal pool	729
(5)	Flood-control pool	N/A
(6)	Spillway crest	729
(7)	Design surcharge (original design)	Unknown
(8)	Top of dam	735
(9)	Test flood surcharge	732.8

d. Reservoir (length in feet)

(1)	Normal pool	2,000
(2)	Flood-control pool	N/A
(3)	Spillway crest pool	2,000
(4)	Top of dam	2,200
(5)	Test flood pool	2,100

e. Storage (acre-feet)

(1) Normal pool	360
(2) Flood-control pool	N/A
(3) Spillway crest pool	360
(4) Top of dam	420
(5) Test flood pool	400

f. Reservoir Surface (acres)

(1) Normal pool	29
(2) Flood-control pool	N/A
(3) Spillway crest	29
(4) Top of dam	37
(5) Test flood pool	34

g. Dam

(1) Type	Earthfill embankment
(2) Length	600 ft
(3) Height	31 ft
(4) Top Width	18 ft
(5) Side Slopes	3:1 upstream and 2:1 downstream

(6)	Zoning	Unknown
(7)	Impervious Core	Unknown
(8)	Cutoff	Unknown
(9)	Grout Curtain	Unknown
(10)	Other	None
h.	Diversion Canal	N/A
i.	Spillway	
(1)	Type	Broad-crested masonry weir
(2)	Length of weir	12 ft
(3)	Crest elevation	729
(4)	Gates	None
(5)	U/S Channel	Upper Kohanza Reservoir
(6)	D/S Channel	Kohanza Brook
j.	Regulating Outlets — Outlet conduit	
(1)	Invert Elevation	704
(2)	Size	18-inch diameter
(3)	Description	Cast Iron
(4)	Control Mechanism	Hand operated
(5)	Other	N/A

SECTION 2: ENGINEERING DATA

2.1 DESIGN DATA

No design data were available for the Upper Kohanza Dam.

2.2 CONSTRUCTION DATA

No construction data were available for the Upper Kohanza Dam.

2.3 OPERATION DATA

There are no provisions for monitoring the reservoir level or the condition of the dam. According to the representative from the City of Danbury, the outlet conduit is only operated during dry periods. The only accounts of the operation of this valve are maintained in the daily work records; however, the amount of discharge is not formally measured.

2.4 EVALUATION OF DATA

a. Availability — The State of Connecticut Water Resources Department provided a data inventory sheet and a brief inspection report submitted by A. M. McKenzie, Civil Engineer, on January 5, 1966. The owner made the site accessible and provided a representative for consultation during the inspection.

b. Adequacy — The limited available data was supplemented by field survey measurements performed by International Engineering Company engineers. However, since there was no information available concerning the dam design and construction, the assessment of the dam was based on the visual inspection, performance history, hydraulic computations of spillway capacity, and approximate hydrologic judgements.

c. Validity — The field inspection indicated that the external features of the Upper Kohanza Dam are similar to those discussed in the 1966 inspection report by A. M. McKenzie.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General — Field inspections of the Upper Konanza Dam were conducted on February 3 and 19, 1981, and areas requiring repair, maintenance, and monitoring were identified. As a result, the general condition of the facility has been determined to be poor. At the time of the first inspection, the reservoir level was 719 NGVD; and there was no flow over the spillway or through the conduit.

b. Dam — The dam is entirely covered by vegetation with the exception of those portions of the upstream slope that are normally beneath the water surface and are covered by riprap (Photo 1). The growth on the dam primarily consists of tall grass, brush, and thicket. Tree stumps ranging from 6 to 18 inches in diameter were noted on the upstream slope above the high water line approximately 20 feet from the eroded area at the midsection of the dam. The trees seemed to have been removed sometime during the last 15 years. Exposed root systems were found largely along the top of the dam in the vicinity of the stumps, but were also noted on the left portion of the dam. Mature trees and saplings were also noted growing on or adjacent to the abutments and downstream toe of the dam.

The slopes of the dam have, for the most part, maintained their original alignments. A narrow footpath has been worn through the ground cover along the top of the dam thus exposing the embankment material. In addition, localized erosion along the top of the dam has exposed the root networks near the surface of the embankment. As a result, the crest of the dam is locally irregular in elevation and shape. There is a slight downward slope of the crest toward the impoundment, and the crest varies by a few feet in width. The only signs of significant deterior- ation of the embankment were located near the top of the exposed riprap slope protection. Near the midpoint of the dam, erosion has resulted in the formation of a 10-foot-wide, 12-foot-long, and 1-foot-deep hole in the upstream slope of the dam at the crest (Photos 2 and 3). The displaced

embankment material has accumulated on the riprap slope protection directly beneath the hole. Local areas on the upstream slope near the top of the dam, where the slope protection has been displaced, are subject to erosion of the underlying embankment fill.

Seepage was observed near the right center of the dam just below the downstream toe. Despite the low reservoir level, the flow from this area was estimated at 10 and 15 gpm of clear water. The small channel cut by the seepage flow and the somewhat marshy environment of this area indicated that the seepage may be significant and has been occurring over a long period of time.

The spillway was found to be in a state of extreme disrepair (Photos 4 and 5). The masonry walls that once formed the spillway approach and discharge channels have collapsed into the spillway. In addition, trees ranging from 4 to 10 inches in diameter growing along the left slope of the spillway channel have been and are being gradually undermined by the flow through the spillway channel. As a result, there are also fallen trees obstructing the spillway. Seepage was also noted flowing out of the rocky spillway channel floor, approximately 30 feet below the spillway crest, at a rate of about 1 gpm.

c. Appurtenant Structures — The masonry valve house containing the control mechanism for the outlet conduit shows signs of deterioration but is still intact (Photo 6). Differential settlement of the foundation has caused cracking in the walls and has resulted in partial separation of the walls from the ceiling. The mechanically operated control valve is still operational, though rusted, (Photo 7). The outlet pipe passes under a masonry slab before emerging approximately 10 feet downstream from the valve stem (Photo 8). At the time of the inspection, there was a flow of approximately 1 gpm in the outlet pipe discharge channel. This discharge appeared to originate from beneath the masonry slab covering the pipe and not the pipe itself. According to the Danbury Water Company representative, the flow was the result of improper closing of the valve. The discharge channel for the outlet has become a collection

point for displaced stones from the retaining walls near the valve house and is also overgrown with brush (Photo 9). There is no means of regulating flow into the pipe on the upstream side of the dam.

d. Reservoir Area — The area surrounding the reservoir is largely residential. The slopes surrounding the impoundment are wooded and appeared to be stable, even with the drawdown of the reservoir.

e. Downstream Channel — The downstream channel follows the natural path of Kohanza Brook and terminates in the Lower Kohanza Lake Reservoir. The channel banks are, for the most part, wooded except in the vicinity of the first downstream home. The only constrictions within the channel are the Zinn Road bridge culvert and the Lower Kohanza Dam.

3.2 EVALUATION

Based on the visual inspection of Upper Kohanza Dam, it has been determined that the facility is in poor condition. The following features may influence the future condition and/or stability of the dam:

(1) The sloughing and displaced riprap on the upstream face will permit further deterioration of the dam, thus weakening the structure.

(2) The trees growing adjacent to and in the spillway channel could fall into the channel, thus further reducing its discharge capacity. This could cause the dam to be overtopped during periods of high project discharge.

(3) The condition of the outlet valve and conduit should be thoroughly assessed to ensure the operability of this outlet and to determine if the discharge observed during the inspection originates from the valve or is the result of seepage along the conduit. Seepage along the outside of the conduit could lead to a piping failure of the dam.

(4) The seepage areas identified near the downstream toe of the dam and on the floor of the spillway channel might adversely affect the stability of the dam by developing into a piping channel.

(5) The worn areas on the crest and the associated low points have decreased the available freeboard above the spillway crest.

(6) The absence of an upstream control on the outlet conduit prohibits closing the pipe if it should rupture within the embankment.

(7) The eventual decay of the root networks within the dam will promote seepage through the structure.

(8) The growth of tall grass, brush and thickets on the embankment and the current state of the spillway indicate a lack of regular maintenance.

(9) Trees growing on or close to the abutments and downstream toe may damage the embankment in the event they are uprooted.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General — The reservoir behind the Upper Kohanza Dam is used to supplement the Danbury public water supply. As a result, the water is only drawn from the reservoir during dry periods. According to a representative from the City of Danbury, the water supply valve was last opened approximately three months ago due to the lack of precipitation in the area. Prior to this recent discharge, the valve had been last opened during a drought in 1965.

b. Description of any Warning System in Effect — There is no formal downstream emergency warning system in effect at the site.

4.2 MAINTENANCE PROCEDURES

a. General — Currently, no regularly scheduled maintenance is performed at the dam. However, the dam is normally checked every week by the Danbury Water Company, and problem areas are noted. Maintenance is reportedly performed during the warmer months and may include mowing, clearing brush, repairs of the dam and/or appurtenances, and clearing the spillway of debris. The daily work sheets that are maintained by the Danbury Water Company provide a record of the dates when work has been was performed, but do not necessarily provide a detailed account of the actual tasks completed. At the time of the inspection there were no indications of any recent maintenance.

b. Operating Facilities — According to a representative from the Danbury Water Company, the outlet conduit valve has never been serviced.

4.3 EVALUATION

The operation and maintenance procedures currently employed at the site are inadequate. Records documenting the operation and maintenance of the

facility and providing a detailed account of the work and/or operations performed should be kept for future reference. In addition, a formal downstream warning system and emergency operationing guidelines should be established. Remedial measures and maintenance recommendations are presented in Section 7.

SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The watershed is 0.41 sq. mi. of relatively undeveloped, rolling-mountainous, and wooded terrain. The dam is an earthfill embankment with a stone spillway channel located on the left abutment of the dam.

The dam and appurtenant structures are in poor condition. The embankment is overgrown with a heavy layer of groundcover; and there are numerous mature trees and saplings growing on the abutments, along the toe of the dam, and within the spillway channel. The stone spillway channel was in a state of extreme disrepair. The stone pavement on the channel floor was displaced and the spillway training walls have, for the most part, collapsed into the channel. As a result, the discharge channel was filled with debris from the training walls and fallen trees.

The lower gatehouse and the masonry outlet structure are in poor condition. The outlet pipe and outlet channel were obstructed by boulders, stones, and fallen trees. There was flow emanating from the outlet despite these obstructions; however, it was not clear if the source of the water was flow through the pipe resulting from a leaky valve or seepage through the dam along the outside of the pipe. In addition, displaced riprap and erosion were noted on the upstream face of the dam near the crest.

5.2 DESIGN DATA

No design data could be found for the original dam construction.

5.3 EXPERIENCE DATA

The original dam, constructed in 1866, was partially breached in February 1869 and restored in the same year.

5.4 TEST FLOOD ANALYSIS

The maximum potential storage capacity (420 ac-ft) and the height (31 ft) of the Upper Kohanza Dam are within the limits established by the Corps in the "Recommended Guidelines for Safety Inspection of Dams", dated September 1979, for the SMALL size category. The hazard classification for the dam is SIGNIFICANT, since there is the potential for the loss of a few lives due to the breach of the dam. Based on the storage capacity, height, and hazard the recommended test flood for the dam is between a 100-year frequency flood and one-half the Probable Maximum Flood (1/2 PMF). Since the failure of the upper dam may effect the lower dam (see Appendix B, pgs. B-14 & B-15), thus increasing the potential impact, the larger test flood was selected. The peak inflow to the reservoir due to this flood in a 0.41 sq. mi. rolling watershed is 1,400 cfs/sq. mi. The inflow due to the test flood (575 cfs) and outflow (240 cfs) will cause the water surface elevation within the impoundment to rise to 732.8 or 2.2 feet below the top of the dam. The capacity of the spillway is 525 cfs with the water surface at the top of the dam (El. 735.0) or 219 percent of the routed test flood outflow.

5.5 DAM FAILURE ANALYSIS

Utilizing the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, the failure outflow due to the water surface within the impoundment at the top of the dam was calculated to be 35,350 cfs. The resulting breach width (120 feet) did not include the spillway section; and therefore, the spillway discharge at the time of failure was included in the failure outflow.

The failure of the Upper Kohanza Dam will cause the water surface within Kohanza Brook in the vicinity of the first downstream home (1,700 feet from the dam) to rise from 0.7 feet at a prefailure outflow of 525 cfs to 7.6 feet after the failure. As a result, the first floor of this structure would be flooded to a depth of at least 0.6 feet. Consequently, the dam breach would damage 1 home and the bridge culvert

at Zinn Road and could potentially cause the loss of a few lives. In addition, the Lower Kohanza Dam may also sustain some structural damage due to the failure of the upper dam (see Appendix B pgs. B-14 & B-15). The most severe damage to the lower dam would result in the breach of the entire embankment and the ensuing flood wave would inundate 4 additional downstream homes, however, such an event is not a certainty. If the lower dam sustains little or no structural damage the routed outflow from the site, due to the upstream dam failure, would not effect those homes downstream of the lower dam. Therefore, the impact area will be limited to that reach of Kohanza Brook between the upper and lower dams. The hazard classification for the Upper Kohanza Dam is SIGNIFICANT since there is the potential for the loss of a few lives.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATIONS

The visual inspection of the dam did not reveal any indications of immediate stability problems. However, localized erosion near the center of the dam on the upstream slope has resulted in the formation of a 12-foot-long, 10-foot-wide, and 1-foot-deep hole just below the crest of the dam. The riprap on the upstream is in fair to good condition. Towards the right abutment portions of the riprap slope protection have been displaced, thus exposing the underlying dam fill. The training walls forming the spillway channel have collapsed, thus obstructing the channel. Trees growing in and along the spillway channel are also contributing to obstruction of the channel. One area of noticeable seepage near the downstream toe of the dam is a potential problem area

The flow in the outlet pipe discharge channel may also be an indication of a potential structural problem. If this discharge originates from seepage along the outside of the conduit the embankment may become susceptible to a piping failure.

6.2 DESIGN AND CONSTRUCTION DATA

Design and construction data were not available to perform an in-depth assessment of the structural stability of the dam.

6.3 POST-CONSTRUCTION CHANGES

The dam was breached in February 1869, and reconstruction of the dam commenced that same year. No documentation was available pertaining to this restoration of the dam.

6.4 SEISMIC STABILITY

The dam is in Seismic Zone 1 and, according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: DAM ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition — The visual inspection of the facility and an evaluation of its past performance indicate that the structure is in poor condition. No evidence of immediate structural instability was observed in the earthfill embankment, but the stone-lined spillway channel was in a state of extreme disrepair. Many areas requiring maintenance and/or monitoring were observed.

Based on the "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", dated April 1978, and the hydraulic/hydrologic computations, the peak inflow and outflow for the test flood are 575 cfs and 240 cfs, respectively. The spillway capacity with the water surface at the top of the dam (El. 735 NGVD) is 525 cfs or 219 percent of the routed test flood outflow.

b. Adequacy of Information — The information available is such that an assessment of the condition and stability of the dam must be based largely on the visual inspection, past performance, and sound engineering judgement.

c. Urgency — It is recommended that the measures presented in Sections 7.2 and 7.3 be implemented within one (1) year of the owner's receipt of this report.

7.2 RECOMMENDATIONS

It is recommended that the owner employ a qualified registered professional engineer to:

(1) Establish a program to monitor seepage flows on a weekly basis. Special attention should be given to observing those areas at

the toe of the dam where evidence of seepage was found, investigating the possibility of seepage along the outlet conduit, and to evaluate the effects of spillway discharges on the downstream slope and toe of the embankment. If warrented remedies for these situations should be formulated and instituted.

(2) Investigate and determine the origin of the seepage in the discharge channel floor and at the toe of the embankment in the vicinity of the outlet pipe and then evaluate the influence each has on the structural stability of the dam.

(3) Perform a detailed hydrologic-hydraulic investigation to access further the potential of overtopping the dam and the need for and means to increase project discharge capacity. In addition, access the spillway's structural ability to withstand high flows.

(4) Evaluate the condition of the outlet conduit and the hand-operated mechanical control valve. If necessary, a program for the repair or renovation of this outlet should be developed. In addition, procedures for the maintenance of the valve should be outlined to ensure that it is kept in good working order.

(5) Provide a means of emergency closure of the outlet conduit on the upstream side of the dam.

(6) Perform a detailed topographic survey identifying the dam, impoundment, and all appurtenant structures. From this survey, a complete set of drawings indicating all pertinent features, including but not limited to spillway(s), conduits, associated structures, wet regions, and areas requiring maintenance, should be developed and filed for future reference.

(7) The trees, stumps and roots on the dam, at the abutments and on the downstream toe should be removed and the resulting voids backfilled with a suitable compacted material. Grass should then be planted on the repaired areas to prevent future erosion.

(8) The crest of the embankment should be leveled and reshaped by backfilling the low points with a suitable compacted material. Grass should be planted on the repaired areas to prevent further erosion.

(9) The eroded areas on the upstream face of the embankment should be backfilled with a suitable compacted material. Those areas subject to wave action should be protected with riprap.

The Owner should implement the recommendations of the Engineer.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures — The following measures should be undertaken within one (1) year of the owner's receipt of this report and continued on a regular basis.

(1) A formal program of operation and maintenance procedures should be instituted and documented to provide accurate records for future reference.

(2) The valve house should be renovated. This would include repairing the roof to prevent leaks, sealing the cracks in the walls and joints, and installing a door that can be locked.

(3) The logs on the upstream face of the dam should be removed.

(4) The cutting of grass and brush on the top, slopes, and toe of the embankment should be instituted as part of the routine maintenance procedures.

(5) An "Emergency Action Plan" should be developed that includes monitoring the project during periods of intense rainfall; an effective preplanned downstream warning system; locations of emergency equipment, materials, and manpower; authorities to contact; and potential areas that require evacuation.

(6) Institute a program of annual technical inspection by a qualified registered professional engineer.

(7) Clear the rocks, trees, brush and other debris from the outlet pipe discharge channel.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Upper Kohanza Dam

DATE 2/3 & 19 /81

TIME 10:00 a.m.

WEATHER Clear, Cold, Windy, 20° F

W.S. ELEV. 719

PARTY:	INITIALS:
1. Jeffrey T. Klaucke	JTK
2. Miron B. Petrovsky	MBP
3. Jerry Waugh	JW
4. Ernst H. Buggisch	EHB
5. Harold Farnham	HF (Matthews Associates)

PROJECT FEATURE:	INSPECTED BY:
1. Dam Embankments	JTK, MBP, JW
2. Value House	JTK, MBP, HF
3. Outlet Conduit	JTK, JW, HF
4. Masonry Outlet Pipe Foundation	MBP, JW, JTK
5. Spillway	JTK, JW, EB.

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Dam Embankments NAME: JTK, MBP, JW

Area Evaluated	Condition
DIKE EMBANKMENT	
Crest Elevation	
Current Pool Elevation	719.0
Maximum Impoundment to Date	
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	Crest is locally irregular in shape.
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	At left abutment spillway retaining walls have deteriorated, but the right abutment appeared sound.
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Embankment	Foot path along crest.
Sloughing or Erosion of Slopes	At center of dam on the upstream slope near the top of the dam on 8-foot-wide, 10-foot- deep, an area has been washed out.
Rock Slope Protection - Riprap Failures	No failures, but upper portion of riprap is overgrown and displaced in local areas.
Unusual Movement or Cracking at or near Toes	None

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Dam Embankment (Continued) NAME: JTK, MBP, JW

Area Evaluated	Condition
Unusual Embankment or Downstream Seepage	Downstream area was swampy, however frozen ground conditions did not permit complete identification of the water sources.
Piping or Boils	None Visible
Foundation Drainage Features	N/A
Toe Drains	N/A
Instrumentation System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: NAME:

Area Evaluated	Condition
OUTLETS WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	N/A
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	N/A
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Valve House NAME: MBP, HF, JW

Area Evaluated	Condition
OUTLET WORKS - CONTROL TOWER	
a. Masonry and Structural	
General Condition	Fair
Condition of Joints	Mortor cracking and missing in many joints.
Spalling	N/A
Visible Reinforcing	N/A
Rusting or Staining of Concrete	N/A
Any Seepage or Efflorescence	No seepage thrugh valve house walls.
Joint Alignment	Walls show signs of differential settlements. Spaces between ceiling and walls.
Unusual Seepage or Leaks in Gate Chamber	Floor of valve house damp.
Cracks	At the intersection of the walls and ceiling. Cracks were also noted in the mortar joints.
Rusting or Corrosion of Steel	N/A
b. Mechanical and Electrical	
Air Vents	N/A
Float Wells	N/A
Crane Hoist	N/A
Elevator	N/A
Hydraulic System	

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Valve House (Continued) NAME: MBP, HF, JW

Area Evaluated	Condition
OUTLET WORKS - CONTROL TOWER (Continued)	
b. Mechanical and Electrical (Continued)	
Service Gates	Hand operated valve was rusted, but was still operable.
Emergency Gates	N/A
Lightning Protection System	N/A
Emergency Power System	N/A
Wiring and Lighting System	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Outlet Conduit NAME: JTK, JW, HF

Area Evaluated	Condition
OUTLET WORKS - TRANSITION AND CONDUIT	
General Condition of Conduit	The 18" Dia. cast iron outlet conduit appeared to be intact however, the majority of the pipe is buried.
Rust or Staining on Concrete	The visible portion of the pipe outlet was rusted.
Spalling	N/A
Eroson or Cavitation	N/A
Cracking	N/A
Alignment of Monoliths	N/A
Alignment of Joints	N/A
Numbering of Monoliths	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Masonry Outlet Pipe Foundation NAME: JTK, JW, MBP

Area Evaluated	Condition
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Masonry	Fair, the masonry slab above the outlet pipe was covered with grass.
Rust or Staining	N/A
Spalling	The mortar joints were severely deteriorated.
Erosion or Cavitation	N/A
Visible Reinforcing	N/A
Any Seepage or Efflorescence	None visible
Condition at Joints	The mortar in the joints were missing in places and had generally deteriorated. As a result there were many stones that were loose or missing from the walls.
Drain holes	
Channel	
Loose Rock or Trees Overhanging Channel	Loose stones in retaining walls near the valve house were noted Small trees were hanging over the channel immediately downstream from the pipe outlet.
Condition of Discharge Channel	Fair, obstructed by large rocks and overgrown brush.

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Spillway NAME: JTK, JW, EB

Area Evaluated	Condition
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Poor
Loose Rock Overhanging Channel	The loose rock overhanding and in the channel is from the deteriorated training walls.
Trees Overhanging Channel	Trees ranging from 4 to 12 inches in diameter.
Floor of Approach Channel	Strewn with rocks from the training walls.
b. Weir and Training Walls	
General Condition of Masonry	Poor
Rust or Staining	N/A
Spalling	The left stone spillway training wall has collapsed into the approach channel and only the lower portion of the right wall was intact. The mortar joints are, for the most part, missing or severely deteriorated.
Any Visible Reinforcing	N/A
Any Seepage or Efflorescence	N/A
Drain Holes	N/A

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

PROJECT FEATURE: Spillway (Continued) NAME: JTK, JW, EB

Area Evaluated	Condition
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Contined)	
c. Discharge Channel	
General Condition	Poor
Loose Rock Overhanging Channel	Loose rocks from the training walls and the left slope were hanging over the channel.
Trees Overhanging Channel	Trees ranging from 4 to 12 inches in diameter.
Floor of Channel	Strewn with rocks and fallen trees.
Other Obstructions	Crude wooden bridge crossing the spillway approach channel.

PERIODIC INSPECTION CHECK LIST

PROJECT: Upper Kohanza Dam DATE: 2/3 & 19/81

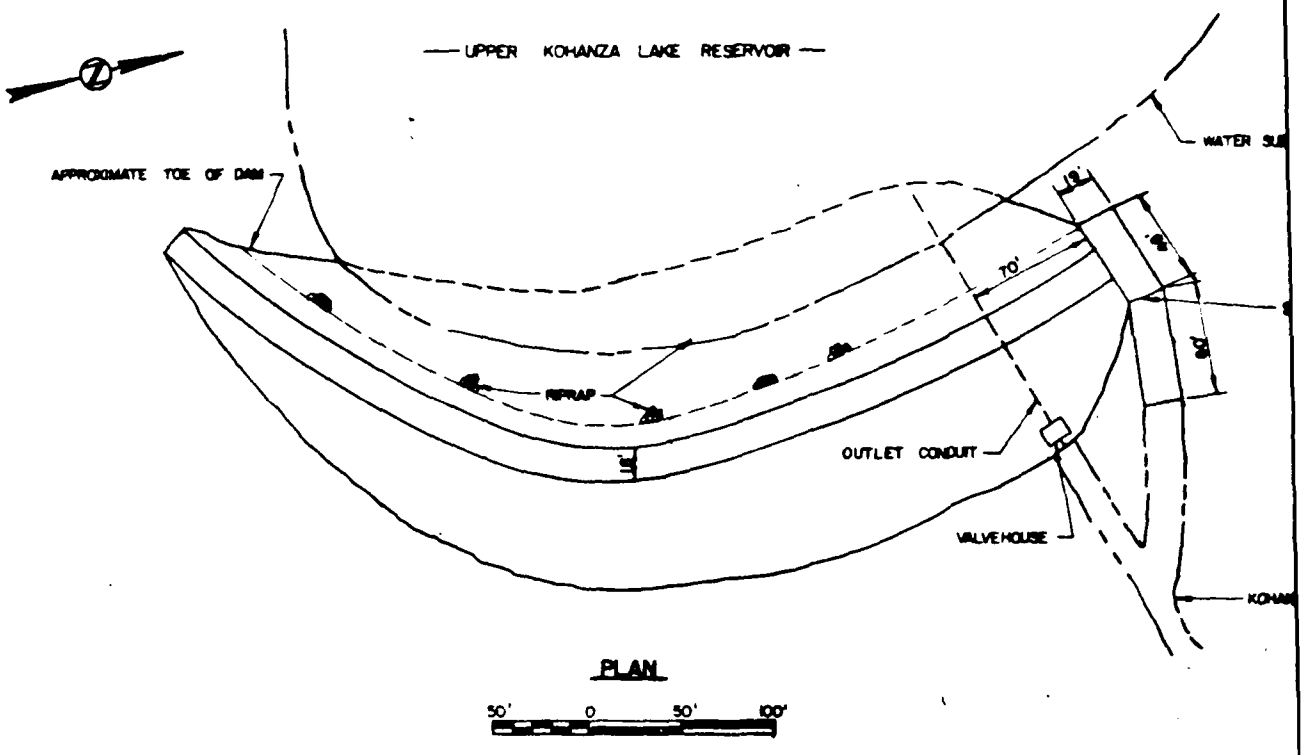
PROJECT FEATURE: Not Applicable NAME:

Area Evaluated	Condition
OUTLET WORKS - SERVICE BRIDGE	
a. Super Structure	N/A
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	N/A
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B

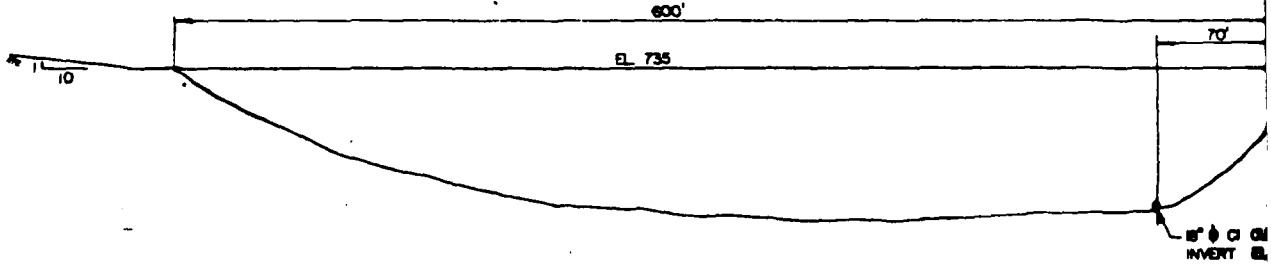
ENGINEERING DATA

SUMMARY OF DATA AND CORRESPONDENCE



PLAN

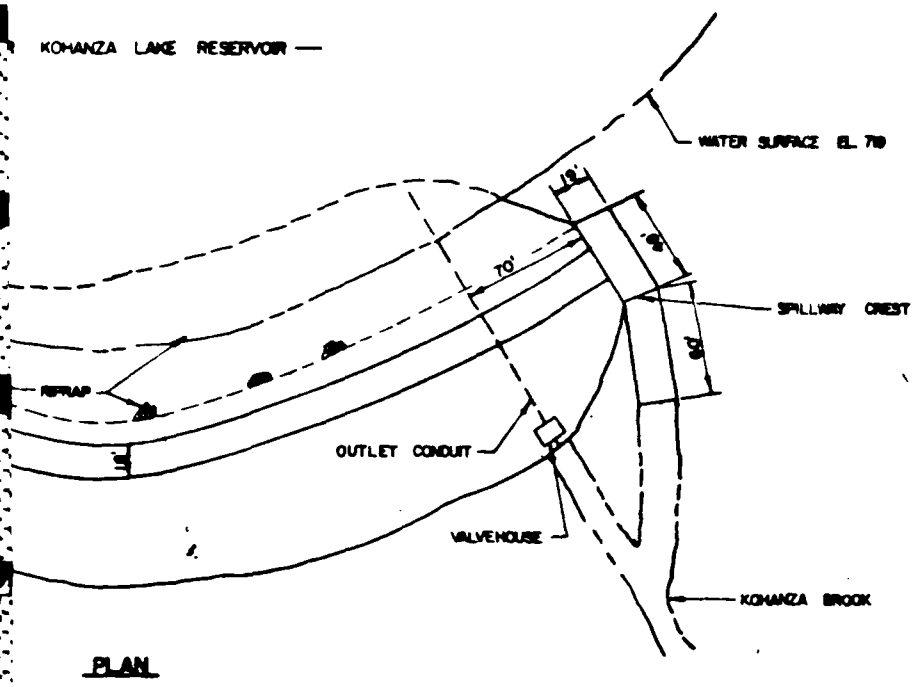
50' 0 50' 100'



PROFILE (ALONG ℄ OF DAM)

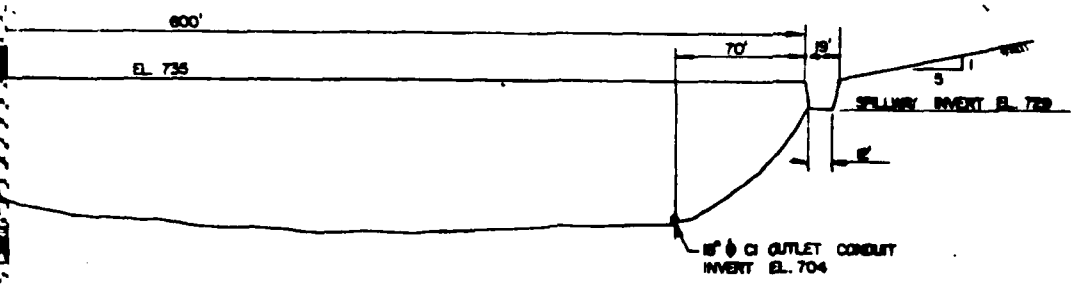
SCALE: HORIZONTAL 50' 0 50' 100'

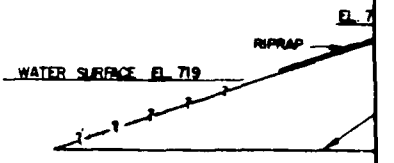
VERTICAL 20' 0 20' 40'

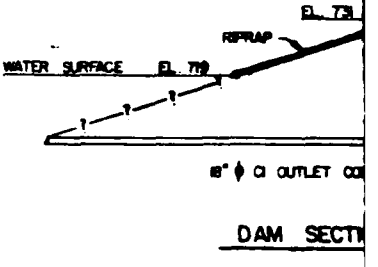


PLAN

0 50' 100'







DAM SECTI

PROFILE (ALONG ℄ OF DAM)

HORIZONTAL 50' 0 50' 100'

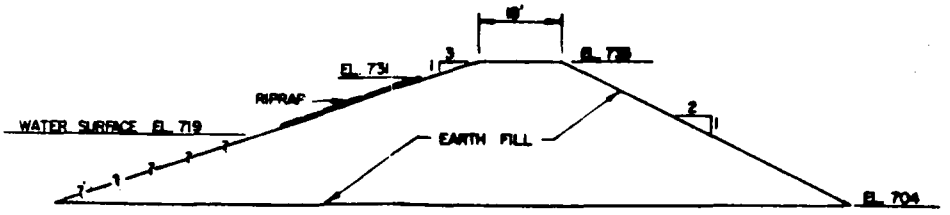
VERTICAL 20' 0 20' 40'

NOTES:

1. THE PLAN, PROFILE, AND SECTIONS WERE DEVELOPED FROM FIELD MEASUREMENTS MADE BY IECO ENGINEERS.
2. ALL ELEVATIONS ARE REFERENCED TO THE SPILLWAY CREST WHICH WAS ASSUMED TO CORRESPOND TO THE WATER SURFACE ELEVATION SHOWN ON THE DANBURY, CONNECTICUT, USGS QUADRANGLE MAP.
3. THE WATER SURFACE ELEVATION SHOWN ON THE SECTIONS CORRESPONDS TO THE WATER SURFACE AT THE TIME OF THE INSPECTION, (FEBRUARY 3, 1978).

SURFACE EL. 719

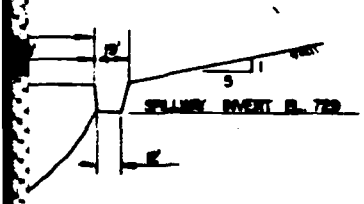
SPILLWAY CREST



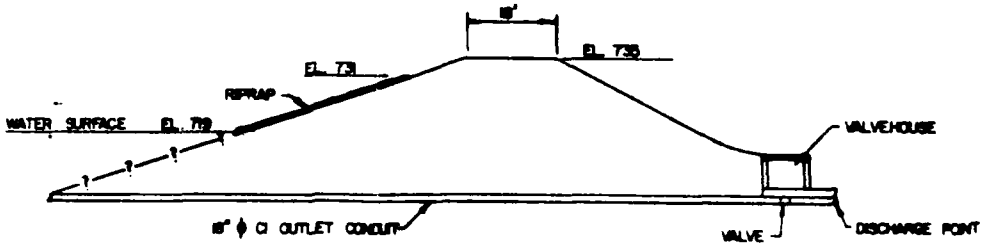
TYPICAL DAM SECTION

10' 0 10' 20' 30' 40'

OHANZA BROOK



CI OUTLET CONDUIT
T EL. 704



DAM SECTION THROUGH VALVEHOUSE

10' 0 10' 20' 30' 40'

NOTES:

1. THE PLAN, PROFILE, AND SECTIONS WERE DEVELOPED FROM FIELD MEASUREMENTS MADE BY IECO ENGINEERS.
2. ALL ELEVATIONS ARE REFERENCED TO THE SPILLWAY CREST WHICH WAS ASSUMED TO CORRESPOND TO THE WATER SURFACE ELEVATION SHOWN ON THE DANBURY, CONNECTICUT, USGS QUADRANGLE MAP.
3. THE WATER SURFACE ELEVATION SHOWN ON THE SECTIONS CORRESPONDS TO THE WATER SURFACE AT THE TIME OF THE INSPECTION, (FEBRUARY 3, 1978).

INTERNATIONAL ENGINEERING CO DARIEN, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS

PLAN, PROFILE, AND SECTIONS
UPPER KOHANZA DAM

KOHANZA BROOK — DANBURY, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
			MARCH 1978	SHEET 8-1

No. _____

Inventoried By _____

Date _____

WATER RESOURCES UNIT
SUPERVISION OF DAMS
INVENTORY DATA

Lat: 73° 29.4'
Long: 41° 25.9'

Name of Dam or Pond UPPER KOHANZA LAKE

Code No. _____

Nearest Street Location _____

Town Danbury

U.S.G.S. Quad. Danbury

Name of Stream Kohanza Brook

Owner City of Danbury

Address _____

1866-rebuilt 1869

Pond Used For _____ Drainage Area .39 sq.mi.

Dimensions of Pond: Width _____ Length _____ Area 29.5 acres

Total Length of Dam 600' Length of Spillway 15'

Location of Spillway East end

Height of Pond Above Stream Bed 20'

Height of Embankment Above Spillway 6'

Type of Spillway Construction Stone channel

Type of Dike Construction fill

Downstream Conditions City of Danbury

Summary of File Data A. M. McKenzie report dated 12-20-65 states "the entire dam seems to be in good condition".

Remarks Many trees; upstream face eroded at one point in middle

Would Failure Cause Damage? Yes Class B

A. M. McKENZIE
CIVIL ENGINEER
M. AM. SOC. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CONN

January 5, 1966.

Water Resources Commission,
State of Connecticut,
State Office Building,
Hartford, 15,
Connecticut.

Gentlemen:

I am enclosing herewith invoice for Consulting Services rendered to your Commission during November and December, 1965.

There also enclosed 4 photographs in connection with the Upper Kohanza Dam in the Town of Danbury.

Yours very truly

A.M. McKenzie.

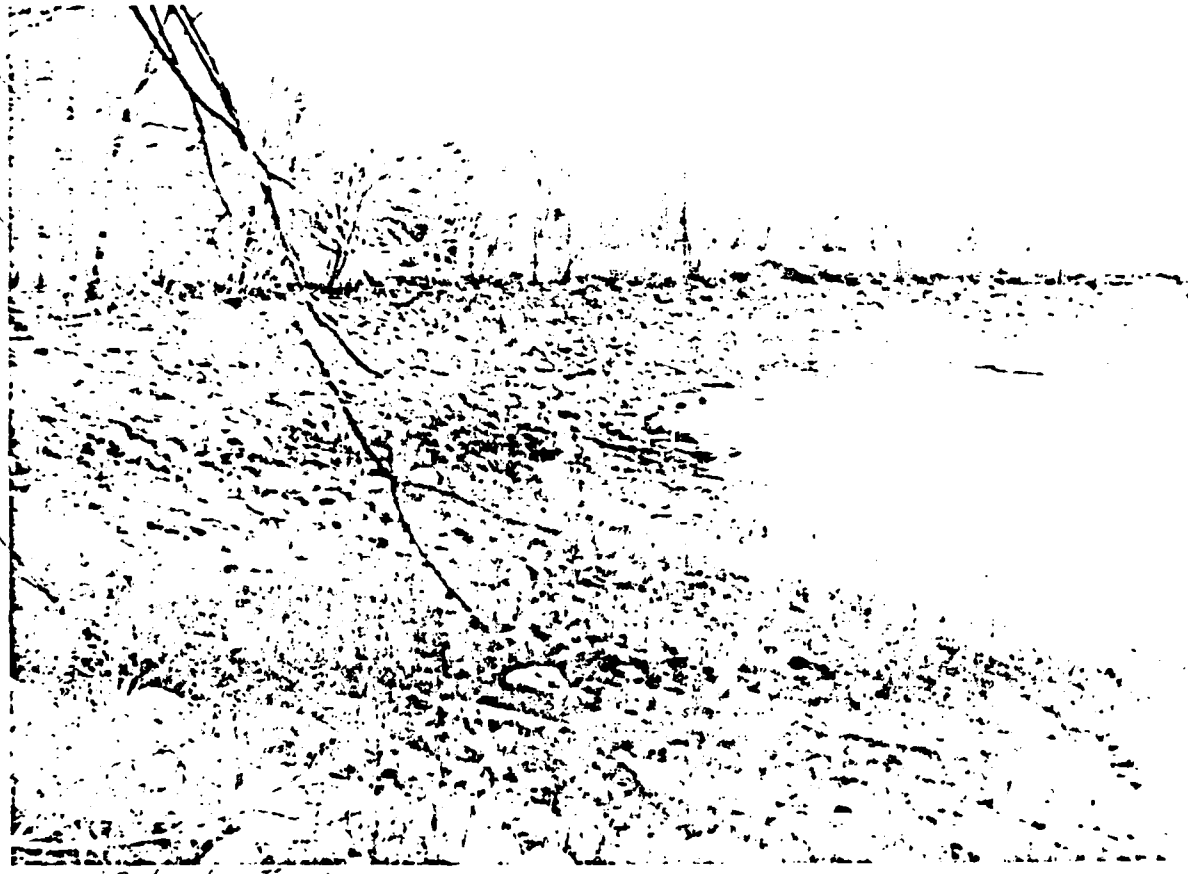


Photo #3

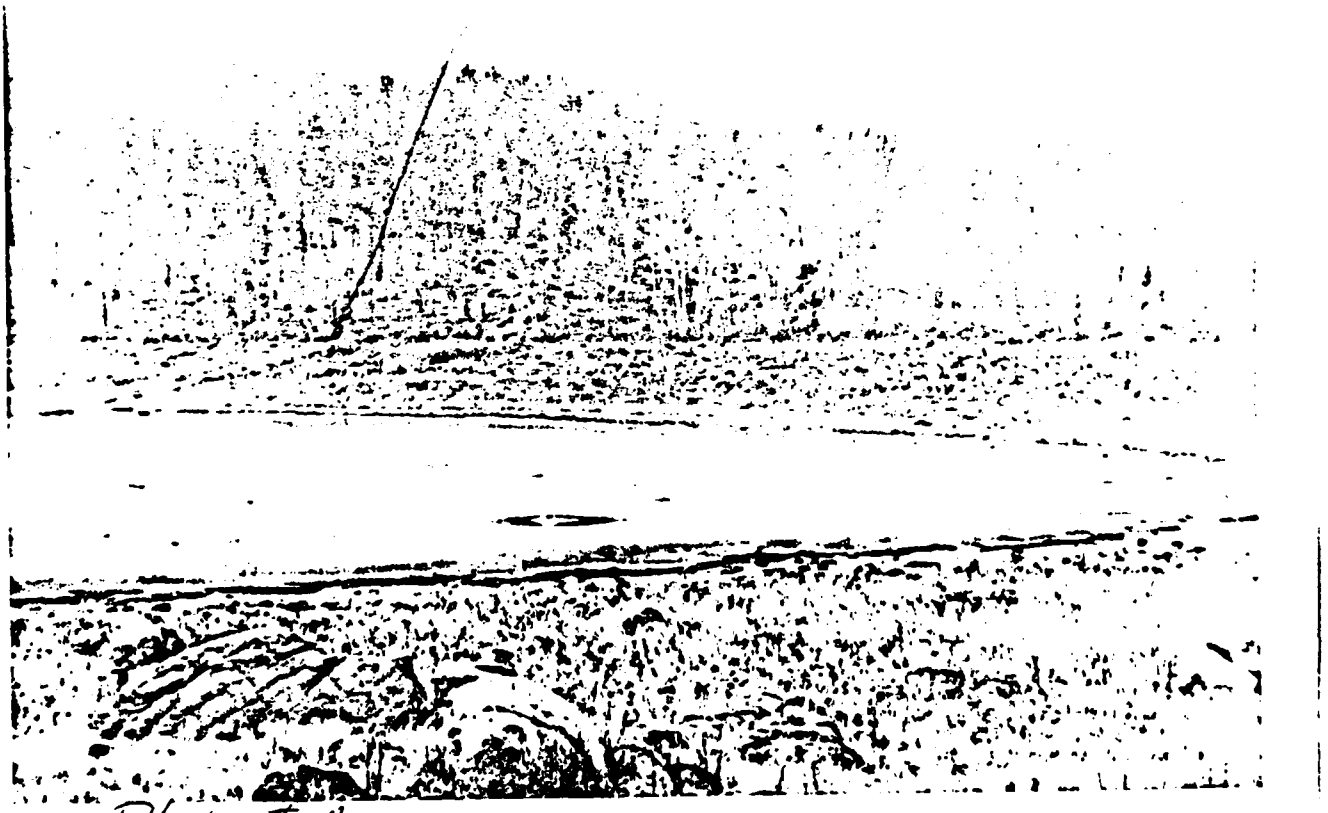


Photo #4

12/16/65

Upper Kohanza Dam
Town of Danbury

Looking ± S. over upstream slope of dam - entire slope is covered by stone rip-rap. Note grass and weed growth indicating no water in pond recently

12/16/65

Upper Kohanza Dam
Danbury

Looking ± N over semi-circular earth fill dam. Note stone rip-rap over entire slope. Water surface is 16'-18' below normal.

Photo #6

Photo #5

12/16/65

Upper Kelawaza Dam,
Danbury.

Looking across and downstream over lower end of spillway. Part of stonewall - ± 3' high - remains on far side.

Upper Kelawaza Dam
Danbury

12/16/65

Looking upstream thru spillway. Remains of stonewall both sides. In background - pond is 10'-11' below spillway. Apparently no water has passed thru for year.

December 9, 1965

Mr. A. M. McKenzie
1500 Main Street
South Meriden, Connecticut

Dear Mr. McKenzie:

Under your contract as consultant to this Commission, will you please inspect and report on the Upper Kohanza Dam in Danbury. This dam is located on the Danbury Quadrangle just west of Chambers Street.

Very truly yours,

William P. Sander
Engineer - Geologist

WPS:js

A. M. McKENZIE
CIVIL ENGINEER
M. AM. SOC. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CONN

December 20, 1965.

Water Resources Commission,
State of Connecticut,
State Office Building,
Hartford, 15,
Connecticut.

Gentlemen:

Ref: Upper Kohanza Dam,
Town of Danbury,
Danbury Quad.

As instructed in your letter of December 9, 1965, I have inspected the Upper Kohanza Dam and submit the following report.

The Upper Kohanza Dam forms a pond which, when full, covers an area of perhaps 20 acres. On the inspection date the water surface was 16' to 18' below normal and, from the appearance of the weed and grass growth, it has been more than a year since the pond has been anywhere near full. The pond was formerly, and perhaps still is, a part of the Danbury water supply.

The dam is entirely of earth fill, about 700' long and has a maximum height of about 35'. It was certainly built more than 50 years ago. The top width is 12' to 18'. The upstream slope is about 2:1 and is completely covered down to the present water level with local stone rip-rap. The downstream slope is about 1½ : 1 and is completely covered with brush, trees and grass. At the north end of the dam is a spillway 16' long which is simply a trench thru the earth fill. The bottom is almost level and is paved with local stone and there is a little ledge rock exposed, also. This channel is about four feet lower than the top of the dam. The spillway does not appear to have had any water over it for several years. A few feet south of the spillway there is a 15"ø cast iron pipe thru the dam with a gate valve in a stone pit at the lower end. The gate valve was either slightly open or leaked enough so that a very slight flow was coming thru.

The entire dam seems to be in very good condition tho the water level is so very low that it is impossible to say that there is no seepage thru the dam. The area draining into the pond is small, about 0.4 of a square mile and I saw only one very small stream running into it. The pond is probably principally spring fed and, due to the low rainfall of the past few years, it is almost empty.

A. M. McKENZIE
CIVIL ENGINEER
M. AM. SOC. C. E.

HYDRAULICS
WATER SUPPLY
LAND DEVELOPMENT

1300 MAIN STREET
SOUTH MERIDEN, CONN

Upper Kohanza Dam (Cont.)

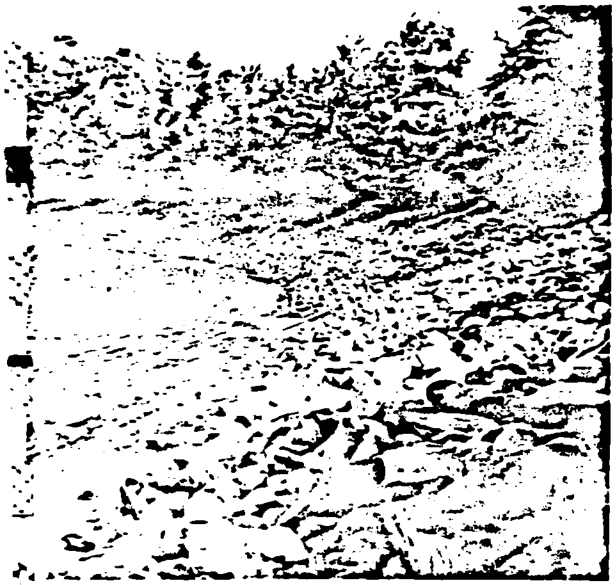
Since the dam seems to be in perfectly good repair but has no water behind it, a definite opinion as to it's condition cannot be given. There are no recommendations except that, if and when the pond is filled again, another inspection should be made. In the mean time I think there is nothing to be concerned about.

Yours very truly

A. M. McKenzie

Photos will be forwarded when ready.

JUNE 1965



JUNE 1965

JUNE 1965

"FRIGHTFUL DISASTER

"Breaking of Dam at Danbury, Conn.—
"Houses and Bridges Swept Away—Ten or Twelve Persons Drowned.

"DANBURY, Conn., Monday, Feb. 1

"The most terrible disaster that has ever occurred in Danbury happened last night, destroying a number of lives and much property. About 7 o'clock in the evening the upper Kohanza dam, which supplies the borough with water, gave way, letting down the water with such force as to carry away the lower dam also. The water of the two dams thus let loose formed an irresistible force and carried away all before it. Flint's dam, which was carried away by a flood last Summer, was again destroyed. The upper Main-street bridge was carried away; also the Balmforth-avenue and White-street bridges, while the Patch-street bridge and the one at LACY, HOYT & CO.'S shop are rendered almost impassable. Houses and small buildings were carried down stream and destroyed. Immense cakes of ice, with rocks, trees, Etc., were carried a great distance. A house in the north end of the town, occupied by the family of Mr. A. CLARK, was carried away with the inmates—a man, his wife and a boy—and all were drowned. The wife and child were found in the stream, near Myrtle-avenue, and the husband was picked up near Peck's ditch. At the latter place the body of a Miss HUMPHREY was found, and near at hand the bodies of Miss HUSTED and Mr. CHARLES ANDREWS' mother was recovered. Thus far five bodies have been found, but as a number of persons are missing it is feared they have been drowned. It is supposed that twelve or fifteen lives were lost."

"THE FLOOD AT DANBURY.

"Great Destruction of Life and Property — Twelve Persons Drowned.

"We take the following account of the damage done by the flood at Danbury, Conn., on Sunday night, from an extra issued by the Danbury Times on Monday:

"Sunday evening, January 31, 1869, will long be remembered by the people of Danbury. Just as the bells ceased to ring the people to their evening worship, the dam of the Upper Kohanzie Reservoir gave way, and the immense body of water therein contained came sweeping down upon our unconscious citizens. Those who lived at the upper part of the town were startled by a sudden rushing, roaring sound, like the driving of a heavy gale of wind. Those indoors could not understand it, as their buildings were not racked, as they would be in such a gale. Many left their houses and went out to listen better, and then discovered before their very doors a boiling, hurling mass of water. The water came upon the village through the gorge above Flint's dam, bringing with it huge masses of ice, and heavy masses of timber. It came with fearful velocity, striking the houses on Main-street, near the river bank, and sweeping them from their foundation in an instant, it swept down the flats along the stream north and east of Main-street, carrying destruction to everything in its reach, and bringing terror to all within its hearing. The amount of property lost cannot be less than fifty thousand dollars, and will probably exceed that amount. The loss of life has been terrible. In the house destroyed in the upper part of Main-street, there were fourteen persons. The terrible scenes and incidents of the night and this morning beggar description. The people have turned out in masses, and at this hour are going over the pathway of the calamity. The scene now is one of great desolation, especially on the site of the houses of those lost. Hardly a trace of where they stood is visible.

"One building is deposited a little way back, badly shattered; the other is a complete wreck, the larger portion lying just south of Patch-street, and some distance below its foundations. The Main, North and White street bridges were destroyed, and the Patch-street bridge so racked as to be unsafe to walk over. CHARLES CHASES'S carriage manufactory, on North-street, was demolished, being struck by the building removed from Main-street. SUNDERLAND'S carpenter-shop, on White-street, was torn from its place. A horse stabled at one end of the building, in some unaccountable way, got out and, swimming to land, came off unharmed. The office and builder's hardware store of the IVES Brothers was flooded, and considerable damage done to the stock. ISAAC W. IVES' lumber-yard was also flooded, and a large lot of lumber swept down the stream, or thrown about the yard in confused shape. Loss was also sustained by STEVENS Brothers and A. ELY, carpenters; P. ROBINSON & CO., flour dealers; LACEY, HOYT & CO., hat manufacturers, and BRADLEY & MANSFIELD, livery stable-keepers. Great cakes of ice, weighing a ton or more, were scattered along the course of the water in great profusion, fences were swept down, outhouses, sheds, &c., damaged.

"The following is a list of the persons killed:
Mrs. HUESTED, an old lady, mother-in-law of CHARLES E. ANDREWS—body recovered; EDWARD CLARK—body recovered; Mrs. EDWARD CLARK, (a body supposed to be her, but badly disfigured, was recovered;) three children of Mr. and Mrs. EDWARD CLARK—bodies not recovered; wife of JAMES BROTHWELL—body not recovered; two children of JAMES BROMWELL—body of one recovered.

"A body was found near Hurlbutt's factory, which was identified by Mrs. HANFORD B. FAIRCHILD as that of Miss FANNY HUMPHREYS, a lady who had left Mrs. FAIRCHILD'S house, on White-street, just before the coming of the flood, and was overtaken by it before she could get across the bridge.

"Right after the water reached White-street, two women were seen clinging to a tree. They cried for help, but the huge cakes of ice and masses of timber surging between them and those who endeavored to help, rendered all attempts ineffectual, and after a few moments they loosed their hold to the tree and were swept from sight. One of these two was undoubtedly Miss HUMPHREYS, but the other is not yet known.

"The damage done the reservoir is very great. About 100 feet of the upper dam and the entire length of the lower dam is swept away. Men are already at work upon the dams, and the waterpipes will be filled in a few days. The foundation of FLINT'S foundry is undermined, and two tenements belonging to HENDRICK BARNUM, on North-street, are somewhat damaged."

APPENDIX C

PHOTOGRAPHS

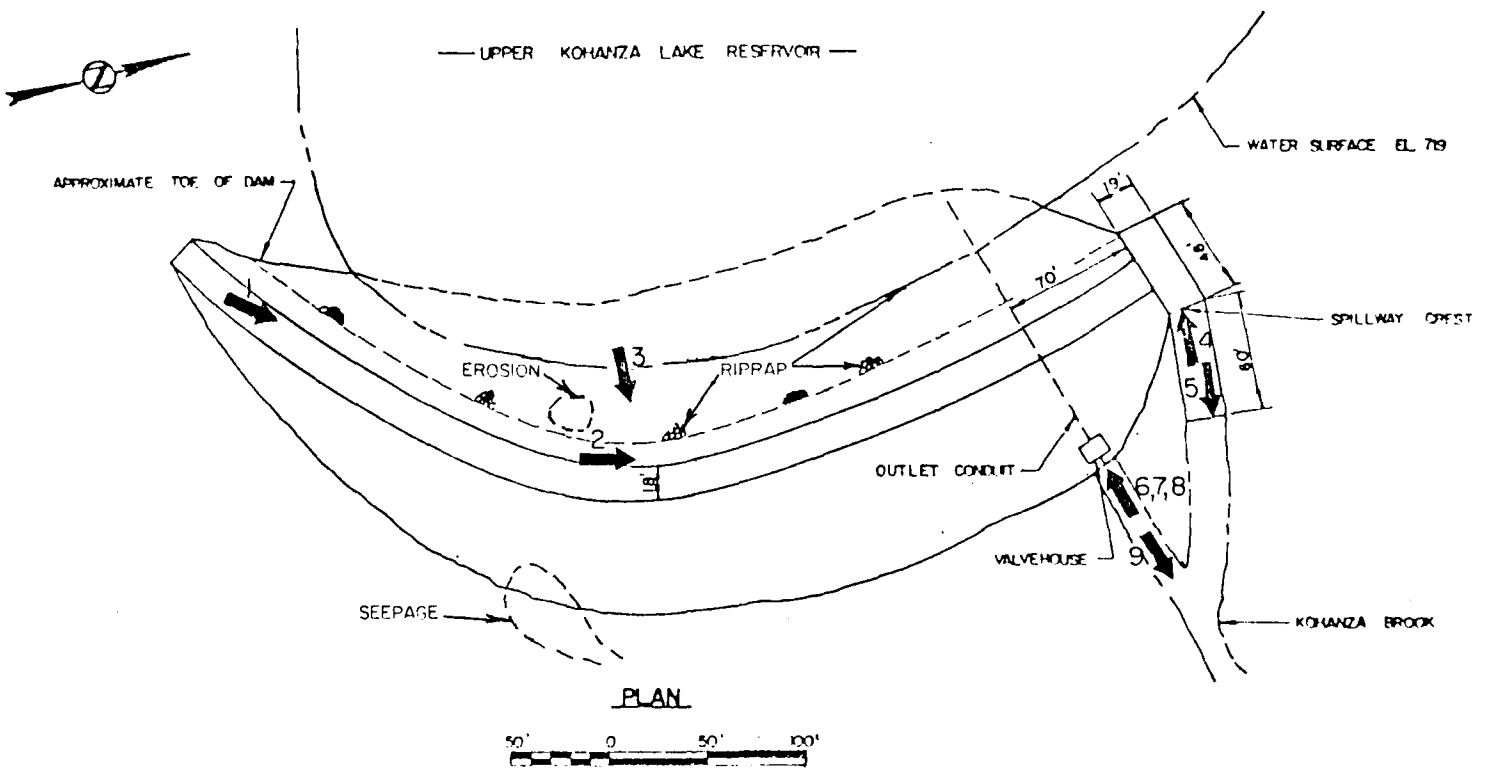


PHOTO LOCATION PLAN

UPPER KOHANZA LAKE DAM

Photo 1. Upstream slope of dam embankment.

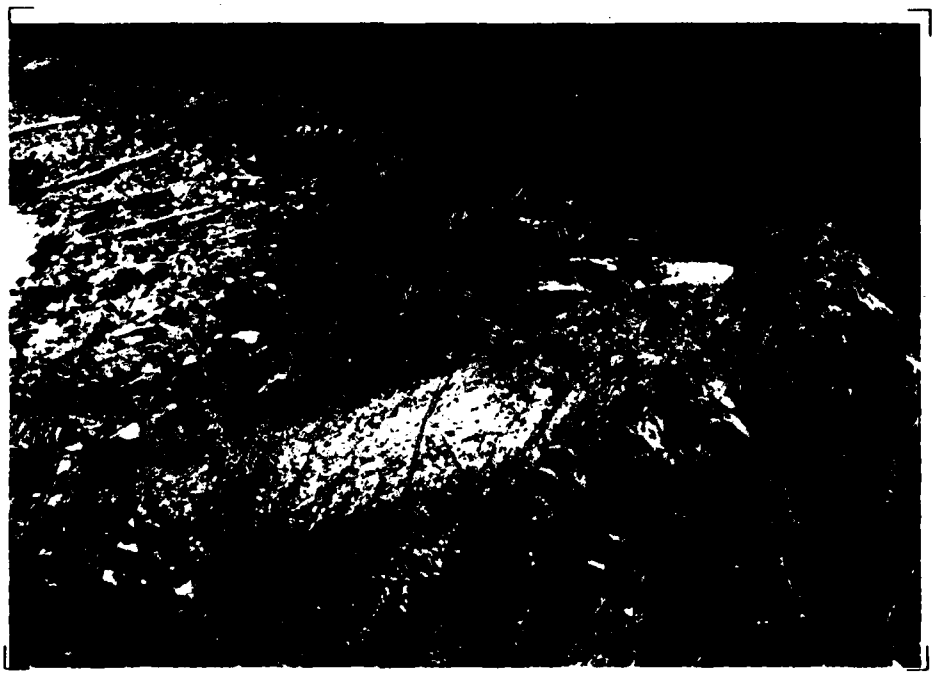


Photo 2. Top and upstream slope of embankment, erosion in foreground.

Photo 3. Erosion on upstream slope.

Photo 4. Spillway channel and right masonry training wall.

Photo 5. Spillway discharge channel and right masonry training wall.

Photo 6. Valvehouse on toe of embankment.

Photo 7. Valve stem of water supply conduit on floor of valvehouse.

Photo 8. Outlet of 18 inch diameter cast iron (C.I.) water supply conduit.

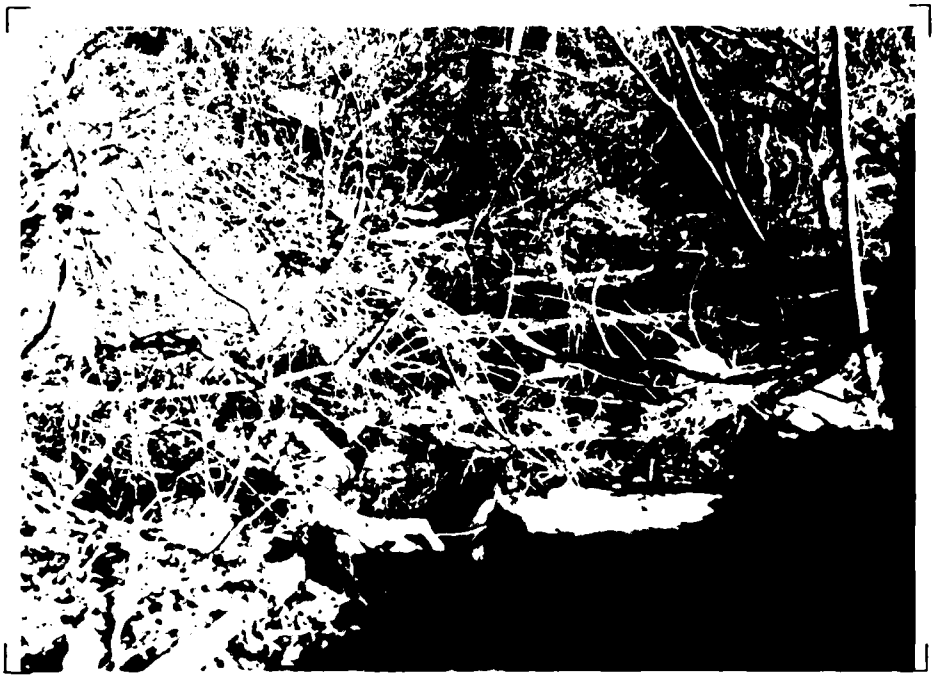
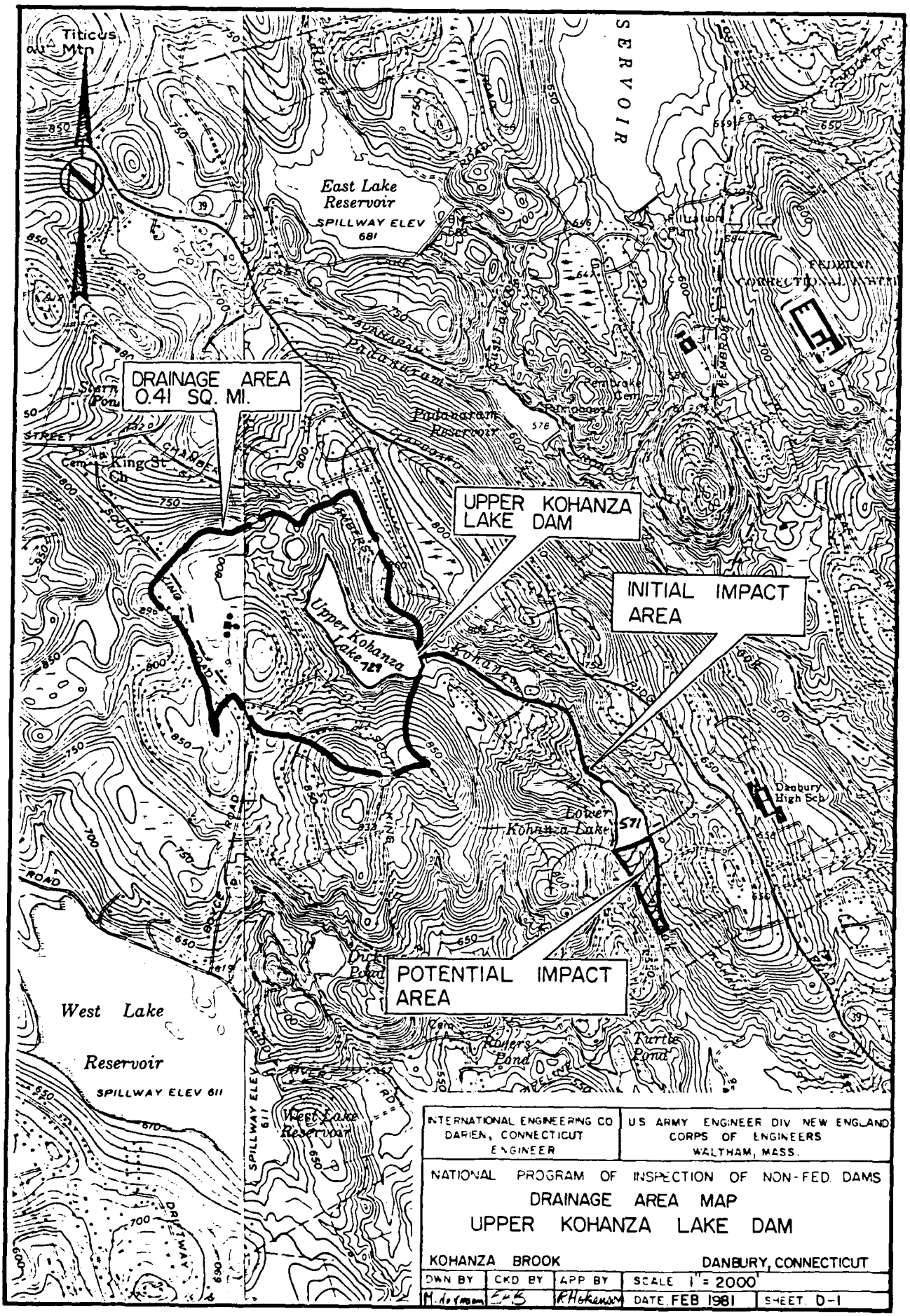


Photo 9. Conduit outlet channel.

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



INTERNATIONAL ENGINEERING CO DARIEN, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

DRAINAGE AREA MAP
UPPER KOHANZA LAKE DAM

KOHANZA BROOK — DANBURY, CONNECTICUT

DWN BY	CKD BY	APP BY	SCALE	SHEET
M. Aderman	E.M.B.	R. Hakenson	1" = 2000'	
			DATE FEB 1981	D-1

HYDROLOGIC/HYDRAULIC INSPECTION

UPPER KOHANZA LAKE DAM, DANBURY, CT

I) PERFORMANCE AT PEAK FLOOD CONDITIONS

1.) PROBABLE MAXIMUM FLOOD (PMF)

a) WATERSHED CLASSIFIED AS ROLLING TO MOUNTAINOUS

b) WATERSHED AREA

UPPER KOHANZA LAKE IS LOCATED ON KOHANZA BROOK; DOWNSTREAM, APPOXIMATELY 3800 FEET, A SECOND LAKE, LOWER KOHANZA, RECEIVES DISCHARGE FROM UPPER KOHANZA LAKE. THE DRAINAGE AREA TRIBUTARY TO KOHANZA LAKE WAS PLANIMETERED FROM USGS 7½' QUADRANGLE SHEETS, BREWSTER NY-CT, AND DANBURY, CT.

i) D.A. TO UPPER KOHANZA LAKE DAM = 0.41 sq.mi.

c) PEAK FLOODS (FROM NED-ACE GUIDELINES)

THE GUIDE CURVES WERE EXTRAPOLATED TO 0.41 SQ. MI, SEE FIGURE 1, AND AN AREAL DISCHARGE OF

INTERNATIONAL ENGINEERING COMPANY, INC.

Project DAM INSPECTION U. KOHANZA
Feature SURCHARGE AT PEAK INFLOWS
Item PEAK FLOODS

Contract No. 2616
Designed J
Checked

Sheet D-2
File No.
Date
Date

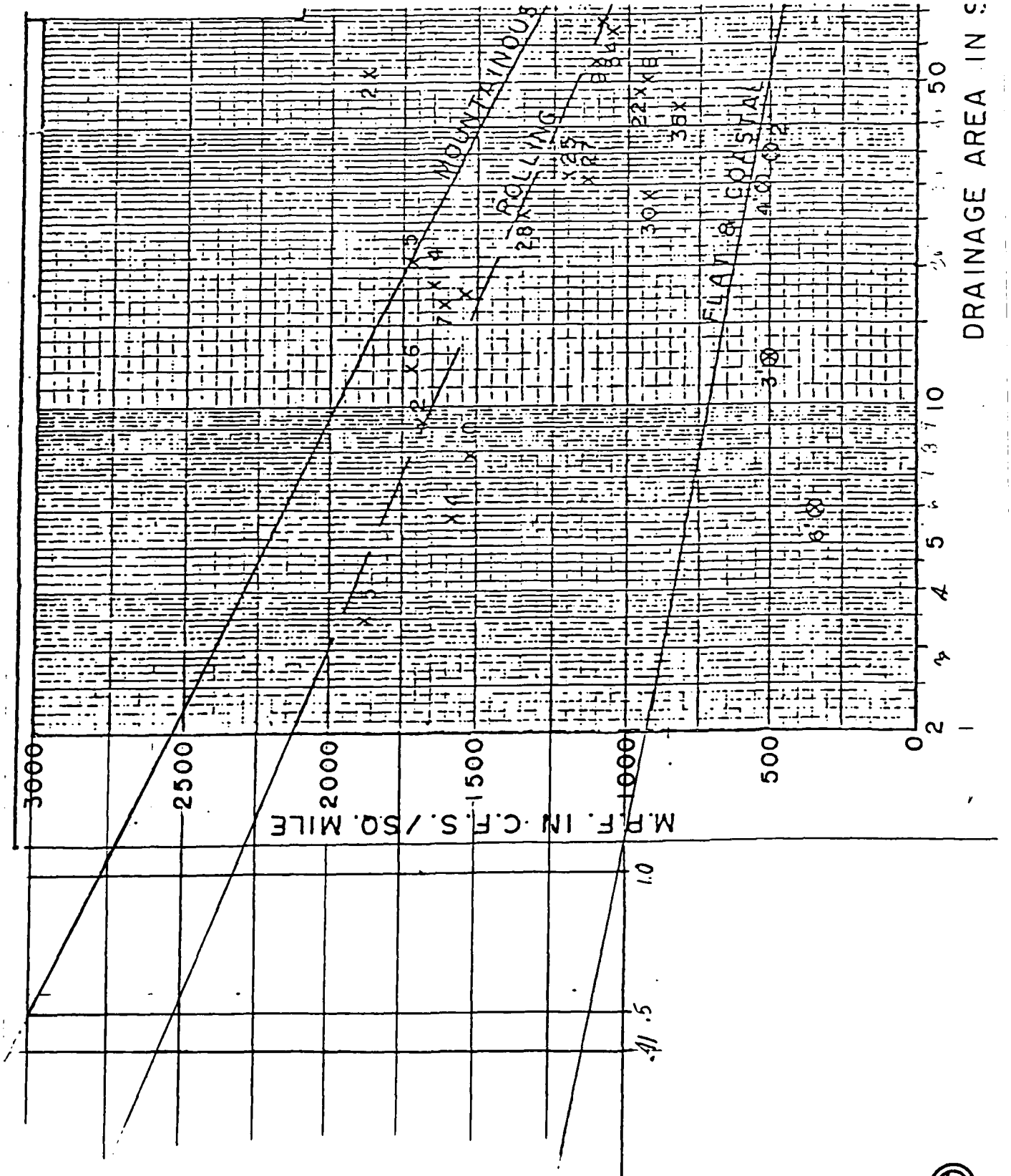


FIGURE 1 EXTRAPOLATED GUIDE CURVES FOR DA ≥ 0.41 sq. mi.

2800 CSM WAS ASSUMED. SUMMARIZING,

i) AREAL UNIT DISCHARGE = 2800 cfs

ii) PMF = 0.41 x 2800 = 1150 cfs

iii) ½ PMF = .5(1150) = 575 cfs

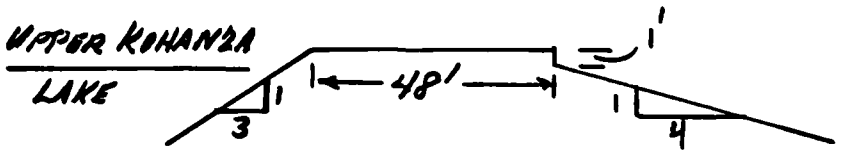
2.) SURCHARGE AT PEAK INFLOWS (PMF & ½ PMF)

a) OUTFLOW RATING CURVE

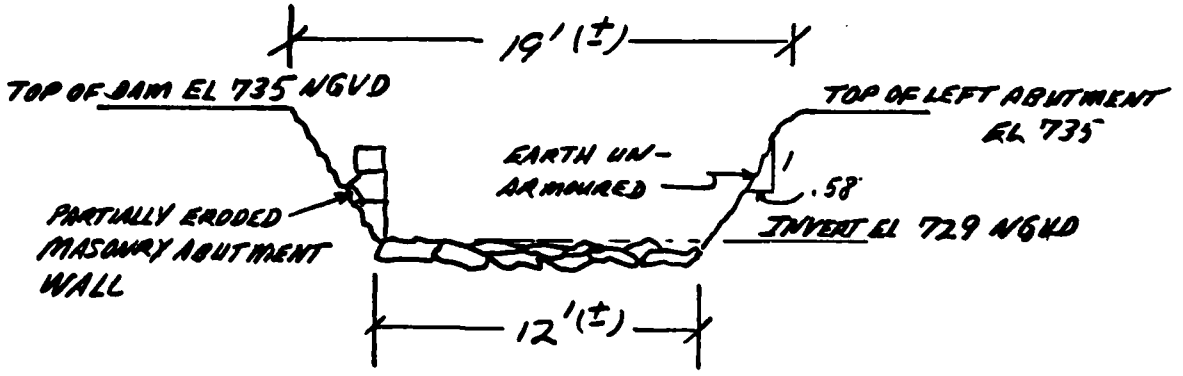
i) SPILLWAY

UPPER KOHANZA DAM SPILLWAY IS SIMILAR TO A CHUTE SPILLWAY AND IS ARMOURED WITH RIPRAP ON THE BOTTOM AND A MASONRY ABUTMENT WALL ALONG THE RIGHT SIDE OF THE SPILLWAY. THE CREST IS 48 FEET IN BREADTH AND 12 FEET IN LENGTH AT THE INVERT. THERE IS NO NOTICEABLE LONGITUDINAL SLOPE TO THE CREST. THE CREST DROPS VERTICALLY 1 FOOT TO THE CHUTE WHICH IS APPROXIMATELY 60 FEET IN LENGTH. THE SPILLWAY LENGTH AT TOP OF DAM IS 19 FEET. THE SIDE SLOPES ARE UNEVEN AND SLIGHTLY OVERGROWN WITH SAPLINGS AND GRASSES.

THE SPILLWAY SECTION AND PROFILE USED IN RATING CURVE DEVELOPMENT IS GIVEN IN THE FIGURES BELOW:



SPILLWAY SECTION (VIEWING EAST)



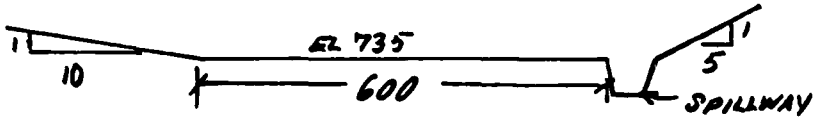
SPILLWAY PROFILE (US VIEW)

BECAUSE OF A RELATIVELY LOW H/b* RATIO AND ROUGH CHARACTERISTICS OF SPILLWAY ABUTMENT AND BOTTOM SURFACES A DISCHARGE COEFFICIENT, C = 2.30 WAS SELECTED. THEREFORE,

* H IS SPECIFIC ENERGY HEAD ON CREST AND b IS CREST WIDTH

$$Q_{SPILLWAY} = 2.30 L H^{\frac{3}{2}} \left(1 + \frac{4}{5}\left(\frac{.58}{L}\right) H\right), \quad L = 12'.$$

ii) EXTENSION OF THE RATING CURVE FOR SURCHARGES OVERTOPPING THE DAM AND/OR ADJACENT TERRAIN.



WIDTH AT TOP OF DAM IS 18'; LENGTH OF DAM IS 600', AS SHOWN IN THE ABOVE PROFILE. THE DISCHARGE COEFFICIENT FOR OVERTOPPING IS C = 2.31 FOR THE REASONS GIVEN ABOVE. THEREFORE,

$$Q_{OVERTOP.} = 2.31 L H'^{\frac{3}{2}} \left[1 + \frac{2}{5}\frac{(15)H'}{L}\right], \quad L = 600, \quad H' = H - 6$$

THEREFORE THE TOTAL OUTFLOW RATING CURVE EQUATION MAY BE GIVEN,

$$Q_T = Q_{SPILLWAY} + Q_{OVERTOP.} = 27.6 H^{\frac{3}{2}}(1 + 3.89 \times 10^{-2} H) + 1390(H-6)^{\frac{3}{2}}(1 + .01(H-6))$$

THE OUTFLOW RATING CURVE FOR UPPER KOHANZA LAKE DAM IS PLOTTED ON FIGURE 2, PAGE D-6.

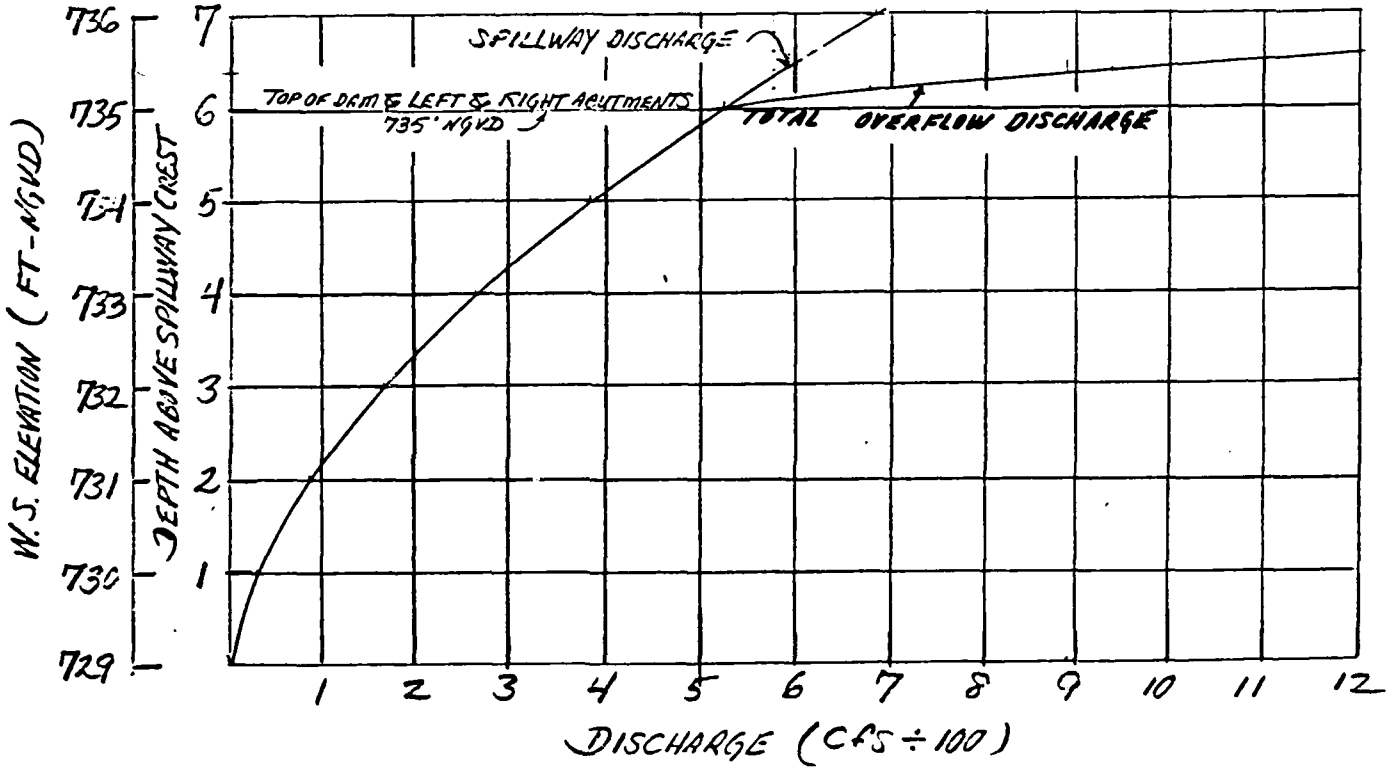


FIGURE 2

b) SURCHARGE HEIGHT TO PASS PEAK INFLOWS (Q_{P_1} & Q'_{P_1})

i) @ Q_{P_1} = PMF $\cong$ 1150 cfs $H_1 = 6.5'$

ii) @ $Q'_{P_1} = \frac{1}{2}$ PMF $\cong$ 575 cfs $H_1' = 6.1'$

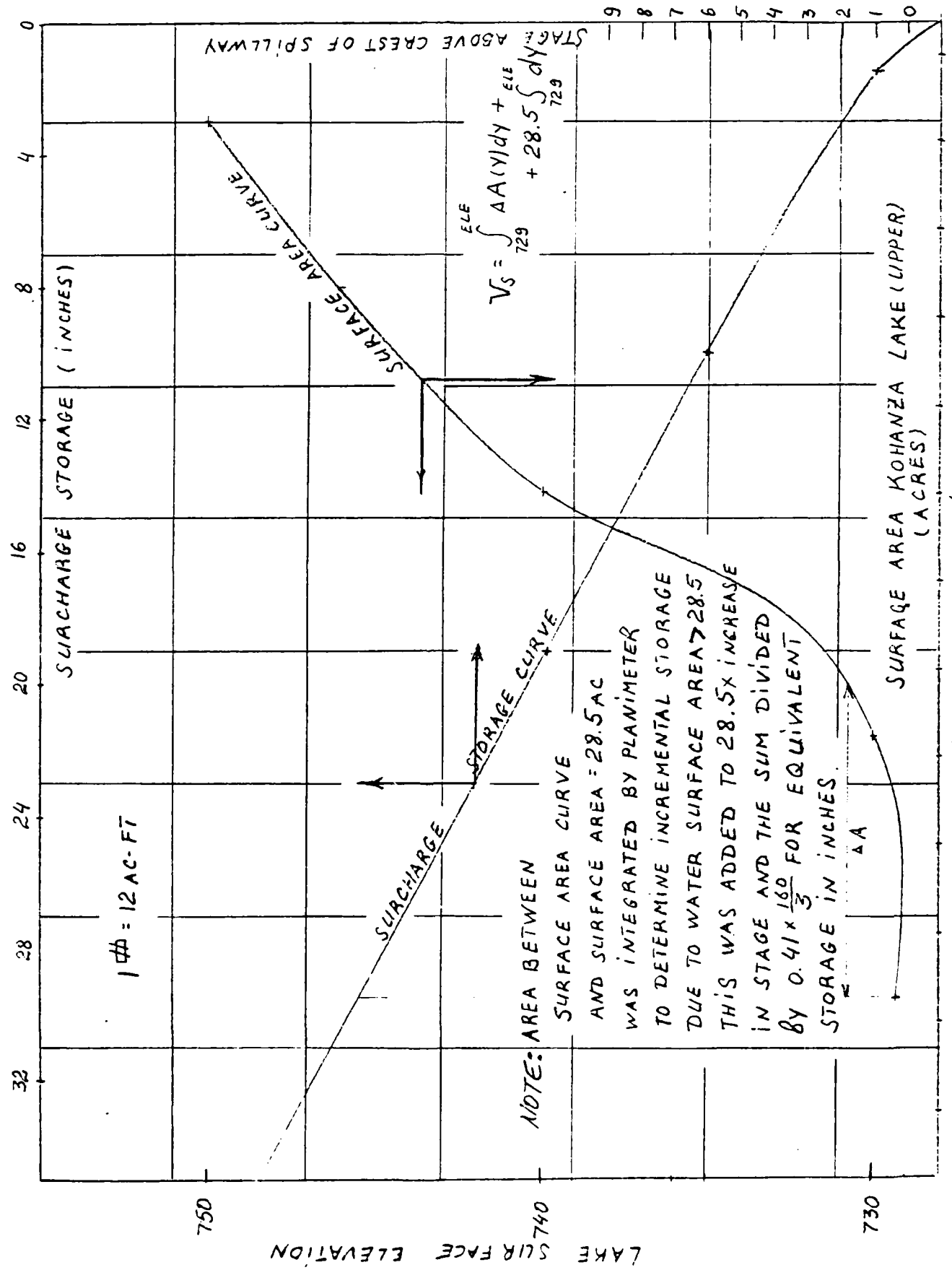
c) EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOWS:

1) STAGE-STORAGE* OF SURCHARGE IS REPRESENTED ON FIGURE 3 PAGE D-7.

* PLANIMETERING OF SURFACE AREAS WITHIN CONTOURS PERFORMED ON QUADS cf.. pp D-1

INTERNATIONAL ENGINEERING COMPANY, INC.

Project DAM INSPECTION U. KOHANZA | Contract No. Z616 | Sheet A-7
Feature SURCHARGE AT PEAK INFLOWS | Designed J | File No.
Item OUTFLOW ATTENUATION | Checked J | Date | Date



2.C. ii NORMAL POOL IS ASSUMED TO BE LEVEL WITH SPILLWAY CREST EL. 729

C. iii DRAINAGE AREA = 0.41 mi²

SUMMARY OF THE T & E. PROCESS IN DETERMINING ATTENUATION OF THE PMF & ½ PMF INFLOW PEAKS IS GIVEN BELOW:

i) PMF:

$H_{Q_{P_1}} = 6.62$

$Q_{P_1} = 1150$

$STO_1 = 4.37$

$Q_{P_2} = 1150\left(1 - \frac{10.85}{19}\right) = 493$

$H_{Q_{P_2}} = 5.8$

$STO_2 = 9.42$ $\quad \overline{STO}_{1-2} = 10.13$ use 10.2

$Q_{P_3} = 1150\left(1 - \frac{10.13}{19}\right) = \underline{\underline{537}}$ cfs ← USE

$H_{P_3} = 6.00$

$STO_3 = 9.60$

$\overline{STO}_{2-3} = 9.87$

$Q_{P_4} = 1150\left(1 - \frac{9.87}{19}\right) = 553$

USE $\underline{\underline{550}}$ cfs.

ii) ½ PMF:

$H_{d_{P_1}} = 5$ assumed

$Q'_{P_1} = 575$

$STO_1 = 7.78$ @ $H = 5$

$Q'_{P_2} = 575\left(1 - \frac{7.78}{9.5}\right) = 104$

$H_{d_{P_2}} = 2.2$

$STOR_2 = 3.15 \qquad \overline{STO}_{1-2} = 5.46$

$$Q'_{P_3} = 575\left(1 - \frac{5.46}{9.5}\right) = 244$$

$H'_{Q_{P_3}} = 3.8 \qquad \overline{STO}_{1-2-3} = 5.49$ WHERE $STO_3 = 5.55$

$$Q'_{P_4} = 575\left(1 - \frac{5.55}{9.5}\right) = 243 \text{ use } \underline{240 \text{ cfs}}$$

d) PEAK OUTFLOWS

$Q_{P_3} = 550$ cfs (PMF OUTFLOW)

$Q'_{P_4} = 240$ cfs ($\frac{1}{2}$ PMF OUTFLOW)

3.) Spillway Capacity Ratio to Peak Inflows & Outflows

a) The Spillway Capacity to top of dam is 525 cfs. Expressed as a percentage of inflow and outflow peak floods,

$$\frac{525 \times 100}{Q_{P_1}} = 45.7\%$$

$$\frac{525 \times 100}{Q_{P_3}} = 95.5\%$$

$$\frac{525 \times 100}{Q'_{P_1}} = 91.5\%$$

$$\frac{525 \times 100}{Q'_{P_4}} = 218.75\%$$

*Note: The low level outlet was not included in the discharge capacity of the dam.

III DOWNSTREAM FAILURE HAZARD

1) POTENTIAL IMPACT AREA

APPROXIMATELY 1700 FEET BELOW THE DAM, A RESIDENTIAL STRUCTURE STRADDLES THE KOHANZA BROOK. THE FIRST FLOOR ELEVATION IS APPROXIMATELY SEVEN FEET ABOVE THE BROOK WATER SURFACE WHICH IS MAINTAINED BY A 3 FOOT MASONRY DAM BETWEEN THE STRUCTURE AND RINN ROAD CULVERT, A 48" RCP, APPROXIMATELY 1900 FEET DOWNSTREAM OF THE DAM. TOP OF ROAD AT THE BROOK-ROAD INTERSECTION IS AT ELEVATION 690± NGVD. ONE HUNDRED FEET DOWNSTREAM FROM THE RINN ROAD - KOHANZA BROOK CROSSING IS LOCATED A SECOND RESIDENTIAL STRUCTURE WITH A FIRST FLOOR ELEVATION AT LEAST 15 FEET ABOVE THE BROOK, WHICH DROPS PRECIPITOUSLY SOUTH OF RINN ROAD. THE FOUNDATION OF THE STRUCTURE IS BETWEEN ELEVATION 680 AND 690 Ft. NGVD. THIRTY-EIGHT HUNDRED FEET FURTHER DOWNSTREAM FROM UPPER KOHANZA DAM IS LOWER KOHANZA DAM. FAILURE OF UPPER KOHANZA DAM IN 1869 DESTROYED LOWER KOHANZA DAM. (SEE NEW YORK TIMES ARTICLE IN APPENDIX B)

AN ADDITIONAL FOUR RESIDENCES BELOW LOWER KOHANZA WILL BE IMPACTED IN THE EVENT OF MULTIPLE BREACHES. THESE STRUCTURES ARE 10→12' ABOVE STREAM BED.

III. 2) FAILURE AT UPPER KOHANZA DAM

a) BREACH WIDTH

i) HEIGHT OF DAM

TOP OF DAM (±) ELEV. 735' NGVD
D/S TOE OF DAM STREAM BED (±) 704' NGVD
$\therefore H = 31'$

ii) MID-HEIGHT OF DAM (±) 719.5' NGVD

iii) APPROXIMATE MID-HEIGHT LENGTH: $W = 300'$
ESTIMATED BY PROJECTION OF DAM HEIGHT AND LENGTH ONTO VALLEY SECTION IMMEDIATELY DOWNSTREAM OF DAM; VALLEY SECTION ESTIMATED FROM 7½' QUADS.

iv) BREACH WIDTH

$$W_B = 300(.4) = 120'$$

b) PEAK FAILURE OUTFLOW (Q_{P_1})

ASSUME SURCHARGE TO TOP OF DAM (ELEV. 735' NGVD)

i) HEIGHT AT TIME OF FAILURE $Y_0 = 31$

ii) SPILLWAY DISCHARGE AT TIME OF FAILURE $Q_s = 525$ cfs
(BREACH DOES NOT INCLUDE SPILLWAY)

iii) BREACH OUTFLOW (Q_b)

$$Q_b = \frac{8}{27} W_B \sqrt{g}\, Y_0^{\frac{3}{2}} = 34,824 \text{ cfs}$$

iv) PEAK FAILURE OUTFLOW (Q_{P_1}) TO KOHANZA BROOK

$$Q_{P_1} = Q_b + Q_s = 35,349, \text{ SAY } 35,350 \text{ cfs}$$

III.2.C) FLOOD DEPTH IMMEDIATELY D/S FROM DAM

$= 0.44(31) = 13.6'$

d) ESTIMATE OF D/S FAILURE CONDITIONS AT POTENTIAL IMPACT AREAS:

A VALLEY PROFILE SEGMENTED INTO 7 PARTS AND REPRESENTATIVE VALLEY SECTIONS OF 6 OF THE CHANNEL SEGMENTS ARE INCLUDED ON PAGES D-20 THROUGH D-22. AREA-CAPACITY, STAGE-DISCHARGE AND DISCHARGE-STORAGE CURVES ARE INCLUDED FOR EACH OF THE 7 SEGMENTS ON PAGES D-23 THROUGH D-28. A DAM-BREAK FLOOD ROUTING WAS PERFORMED THROUGH REACH "F" ASSUMING LOWER KOHANZA DAM FAILS WHILE DISCHARGING THE PMF* (SEE PHASE I REPORT FOR LOWER KOHANZA) WHEN THE ROUTED FLOOD WAVE FROM THE UPPER KOHANZA BREACH REACHES THE DAM. THE WORST EVENTUALLY IS ASSUMED, NAMELY THAT THE LOWER DAM IS ENTIRELY BREACHED AS PER HISTORICAL REFERENCE INCLUDED IN APPENDIX B DESCRIBING THE FIRST MULTIPLE FAILURE IN 1869. SUMMARIES OF THE GRAPHICAL ROUTINGS FOR EACH OF THE SEVEN REACHS ARE GIVEN ON PAGES D-13 THROUGH D-17. INCREASES IN STAGES, INITIAL STAGES AND FINAL STAGES ARE SUMMARIZED ON PAGE D-18.

* ASSUMING THAT LOWER KOHANZA LAKE SPILLWAY DISCHARGES THE ½PMF WHEN UPPER KOHANZA DAM FAILS WILL NOT APPRECIABLY AFFECT THE COMPUTATIONS FOR ROUTING.

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE:

REACH A.

PRE-BREAK DISCHARGE, $Q_s = 525$ CFS

PRE-BREAK CHANNEL STORAGE REDUCTION, $\Delta \mathcal{V}_A = \pm 7$ Ac-ft

DAM-BREAK INFLOW PEAK, $Q_{p_1} = \pm 35{,}000$ cfs

VOLUME UNDER INFLOW HYDROGRAPH, $S = 420$ Ac-ft

AVE. DEPTH FT	$\mathcal{V}_A$ Ac-ft	$Q_{p_2} = Q_{p_1}\left(1 - \frac{\mathcal{V}_A - \Delta\mathcal{V}_A}{S}\right)$
5.0	70	29,750
8.3	124	25,520
10.0	167	21,670

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH TROUGH REACH A: (SEE CURVE, PP D-23)

ROUTED INFLOW, $Q_{p_2} = 25{,}520$ cfs

STORAGE DETAINED FROM INFLOW IN REACH A, $\mathcal{V}_A - \Delta\mathcal{V}_A = 126 - 7 =$ 119 Ac-ft

INITIAL STAGE: .70'
FINAL STAGE: 8.25
INCREASE IN STAGE: 7.55'

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE:

REACH B.

PRE-BREAK DISCHARGE, $Q_s =$

PRE-BREAK CHANNEL STORAGE REDUCTION, $\Delta \mathcal{V}_B = \pm 3$ Ac-ft

DAM-BREAK INFLOW PEAK, $Q_{p_1} = 25{,}520$ cfs

VOLUME UNDER INFLOW HYDROGRAPH, $S = 420 - 119 = 301$ Ac-ft

AVE. DEPTH	$\mathcal{V}_B$ Ac-ft	$Q_{P_2} = Q_{P_1}\left(1 - \frac{\mathcal{V}_B - \Delta\mathcal{V}_B}{S}\right)$
3.0	19	24,150
5.0	33	22,980
10.5	60	20,700

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH REACH B: (SEE CURVE, PP. D-25)

ROUTED INFLOW, Q_{P_2} = 22,300 cfs

STORAGE DETAINED FROM INFLOW IN REACH A, $\mathcal{V}_B - \Delta\mathcal{V}_B = 41 - 3 = \underline{38}$ Ac-ft
INITIAL STAGE : 0.5'
FINAL STAGE : 6.5'
INCREASE IN STAGE : 6'

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE: REACH C,

PRE-BREAK DISCHARGE, Q_S =

PRE-BREAK CHANNEL STORAGE REDUCTION, $\Delta\mathcal{V}_{C_1} = \pm 2$ Ac-ft

DAM-BREAK INFLOW PEAK, Q_{P_1} = 22,300 cfs

VOLUME UNDER INFLOW HYDROGRAPH, $S = 301 - 38 = \underline{263}$ Ac-ft

AVE. DEPTH	$\mathcal{V}_{C_1}$: Ac-ft	$Q_{P_2} = Q_{P_1}\left(1 - \frac{\mathcal{V}_{C_1} - \Delta\mathcal{V}_{C_1}}{S}\right)$
5.0	9.5	21,500
10.0	22.9	20,370
15.0	44.4	18,560

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH REACH C: (SEE CURVE, PP. D-27)

ROUTED INFLOW, Q_{P_2} = 20,000 cfs

STORAGE DETAINED FROM INFLOW IN REACH C_1, $\mathcal{V}_{C_1} - \Delta\mathcal{V}_{C_1} = 27.3 - 2 \simeq \underline{25.0}$ Ac-ft
INITIAL STAGE : 1.0
FINAL STAGE : 11.0'
INCREASE IN STAGE : 10'

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE: LOWER KOHANZA LAKE

PRE-BREAK DISCHARGE, Q_s = 1000 cfs (RESERVOIR ROUTED PMF)
SURCHARGE REQUIRED: 1.30"; SURCHARGE EL: 576.9
PRE-BREAK RESERVOIR STORAGE REDUCTION, ΔV_c = 67 AC-ft

DAM-BREAK INFLOW PEAK, Q_{p_1} = 20,000 cfs

VOLUME UNDER INFLOW HYDROGRAPH, S = 263-25 ≅ 240 AC-ft

ELEV.	V_c : AC-ft	$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_c - \Delta V_c}{240}\right)$
576.9	67	20,000
579.7	102	17,080
583.5	154	12,750

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH RESERVOIR C: (SEE CURVE, PP. D-29)

ROUTED INFLOW, Q_{p_2} = 15,300 cfs ; MAX. SURCHARGE STORAGE, V_c = 123 AC-ft.
MAX. SURCHARGE EL.: 581.3 ; INCREASE IN STAGE: 4.4'

DAM-BREAK FLOOD AT LOWER KOHANZA LAKE WHEN POOL REACHES MAXIMUM ELEVATION BECAUSE OF UPPER KOHANZA DAM-BREAK FLOOD.

$$Q_{DB} = \frac{8}{27}\sqrt{g}\, Y_0^{3/2} W_B$$

W_B = 235' (FULL LENGTH AT MOHEIGHT AS PER HISTORICAL RECORD DATED 1869, APPENDIX B)

$Y_0 = 22 + H = 22 + 10.3 = 32.3$ ft

$$Q_{DB} = \frac{8}{27}\sqrt{32.2}\,(32.3)^{3/2} \times 235 = 722\text{00 cfs}$$

DEPTH D/S OF DAM. = .44(32.3) = 14.2'

Q_{I_1} = 72,200 − 15,300 = 56,900 cfs

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE:

REACH D:

PRE-BREAK DISCHARGE, Q_s = 15,300

PRE-BREAK CHANNEL STORAGE REDUCTION, ΔV_D = 36 AC-ft
INITIAL STAGE IN CHANNEL: 10.5
DAM-BREAK INFLOW PEAK, Q_{p_1} = 56,900 cfs

VOLUME UNDER INFLOW HYDROGRAPH, S = 123+55* = 178 AC-ft

AVE. DEPTH (ft)	V_D: AC-ft	$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_D - \Delta V_D}{178}\right)$
11.5	36	56,900
16.5	65	47,630
19.8	90	39,640

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH REACH D: (SEE CURVE, PP. D-31)

ROUTED INFLOW, Q_{p_2} = 45,400 cfs;

STORAGE DETAINED FROM INFLOW IN REACH D; $V_D - \Delta V_D$ = 72 - 36 = 36 AC-ft.
STAGE IN CHANNEL FOLLOWING DAM-BREAK: 17.7
INCREASE IN STAGE: 7.2

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE:

REACH E:

PRE-BREAK DISCHARGE, Q_s = 15,300 cfs
INITIAL STAGE IN CHANNEL: 8.0
PRE-BREAK CHANNEL STORAGE REDUCTION, ΔV_E = 56 AC-ft

DAM-BREAK INFLOW PEAK, Q_{p_1} = 45,400 cfs

VOLUME UNDER INFLOW HYDROGRAPH, S = 178 - 36 = 142 AC-ft

* STORAGE BELOW NORMAL POOL ESTIMATED FROM EQUATION, $V = 9.96 \times 22/4 \cong 55$ AC-ft

AVE. DEPTH (ft)	$\forall_E$: AC-ft	$Q_{P_2} = Q_{P_1}\left(1 - \frac{\forall_E - \Delta\forall_E}{S}\right)$
9.5	70	40,920
11.4	90	34,530
12.3	100	31,330

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH REACH E : (SEE CURVE, PP. D-33)

ROUTING INFLOW, Q_{P_2} = 33,700 cfs

STORAGE DETAINED FROM INFLOW IN REACH E; $\forall_E - \Delta\forall_E$ = 95 − 56 = 39 AC-ft
STAGE IN CHANNEL FOLLOWING DAM BREAK: 11.8
INCREASE IN STAGE: 3.8'

DETERMINATION OF PLOTTING POINTS FOR GRAPHICAL ROUTING PROCEDURE:

REACH F:

PRE-BREAK DISCHARGE, Q_s = 15,300
INITIAL STAGE IN CHANNEL: 5'
PRE-BREAK CHANNEL STORAGE REDUCTION, $\Delta\forall_F$ = 366 AC-ft

DAM BREAK INFLOW PEAK, Q_{P_1} = 33,700 cfs

VOLUME UNDER INFLOW HYDROGRAPH, S = 142 − 39 = 103 AC-ft

AVE. DEPTH (ft)	$\forall_F$: AC-ft	$Q_{P_2} = Q_{P_1}\left(1 - \frac{\forall_E - \Delta\forall_F}{S}\right)$
4.9	360	35,600
5.3	390	25,850
5.5	420	16,030

GRAPHICAL ROUTING OF INFLOW HYDROGRAPH THROUGH REACH F: (SEE CURVE, PP. D-35)

ROUTED INFLOW, Q_{P_2} = 18,200 cfs

STORAGE DETAINED FROM INFLOW IN REACH F; $\forall_F - \Delta\forall_F$ = 412 − 366 =
STAGE IN CHANNEL FOLLOWING DAM BREAK: 6'
INCREASE IN STAGE: 6 − 5 = 1'
46 AC-ft

SUMMARY OF AVERAGE DEPTHS AT PEAK DISCHARGES IN REACHES A THROUGH F.

REACH	PEAK INFLOW	PEAK OUTFLOW	MAXIMUM STAGE (ABOVE STREAM BED AT OUTLET)
A	35,000 *	25,520	8.25'
B	25,520	22,300	6.50'
C,	22,300	20,000	11.0
C	20,000	15,300	10.3 (ABOVE SPILLWAY CREST)
D	56,900 *	45,400	17.7
E	45,400	33,700	11.8
F	33,700	18,200	6.0

*NOTE: DAM-BREAK FLOODS

REACH	INITIAL STAGE	FINAL STAGE	Δ STAGE
A	0.7'	8.25'	7.55'
B	0.5'	6.5'	6.0'
C,	1.0'	11.0'	10.0'
C			4.4
D	10.5'	17.7	7.2
E	8.0'	11.8'	3.8'
F	5.0'	6.0'	1.0'

III SELECTION OF TEST FLOOD

1) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES

a) SIZE: STORAGE (TO TOP OF DAM) $= \pm 420$ AC-ft. > 50 AC.ft.

HEIGHT $= \pm 31$ ft > 25 ft.

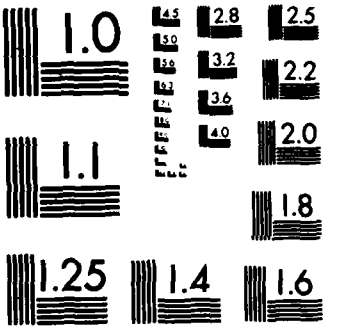
∴ SIZE IS SMALL

b) HAZARD POTENTIAL: BASED ON D/S FAILURE ANALYSIS AT POTENTIAL IMPACT AREA BELOW LOWER KOHANZA DAM ASSUMING LOWER KOHANZA FAILS COMPLETELY AS PER HISTORICAL RECORD WHEN UPPER KOHANZA FAILS A HIGH HAZARD IS THE CLASSIFICATION.

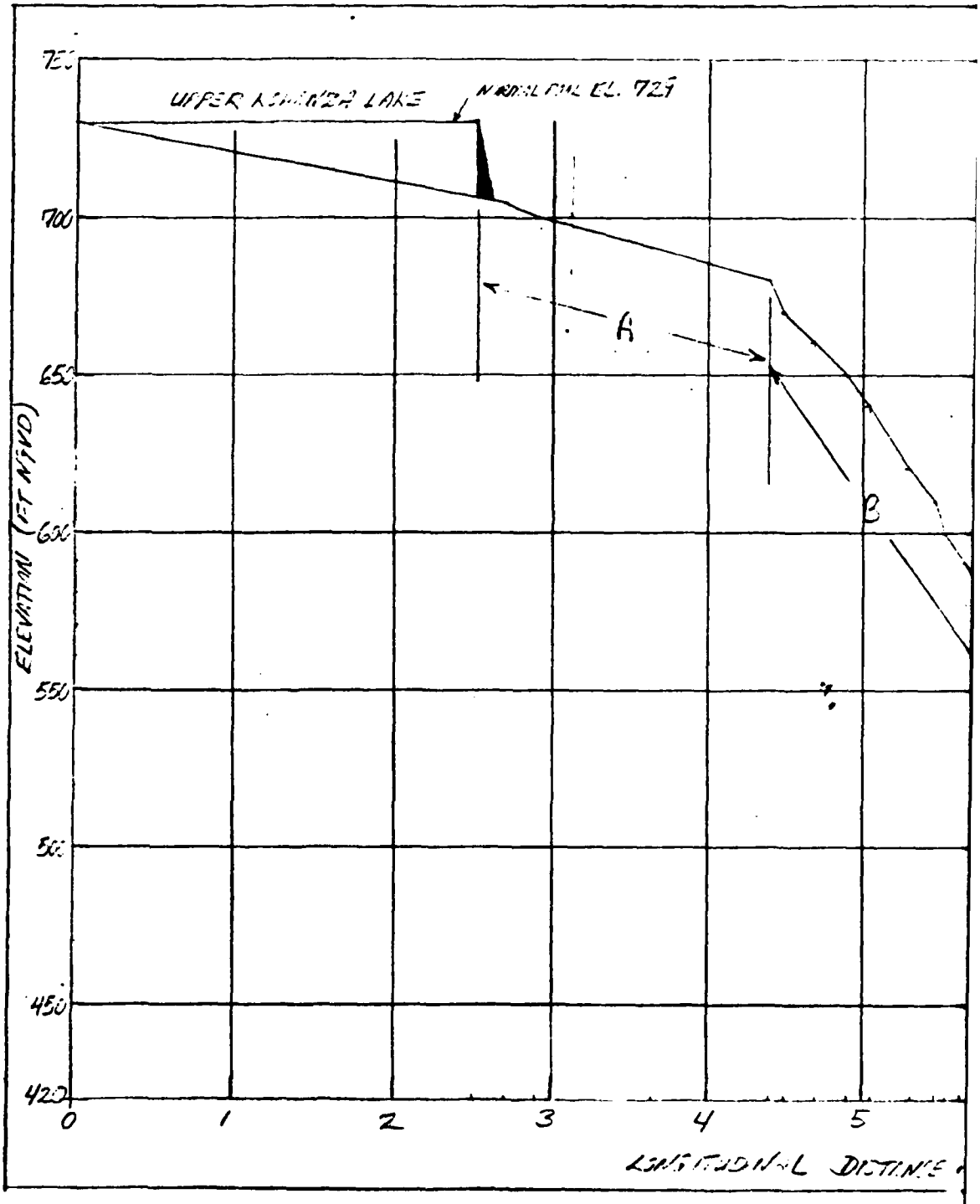
2) TEST FLOOD: ½ PMF ≅ 575 cfs

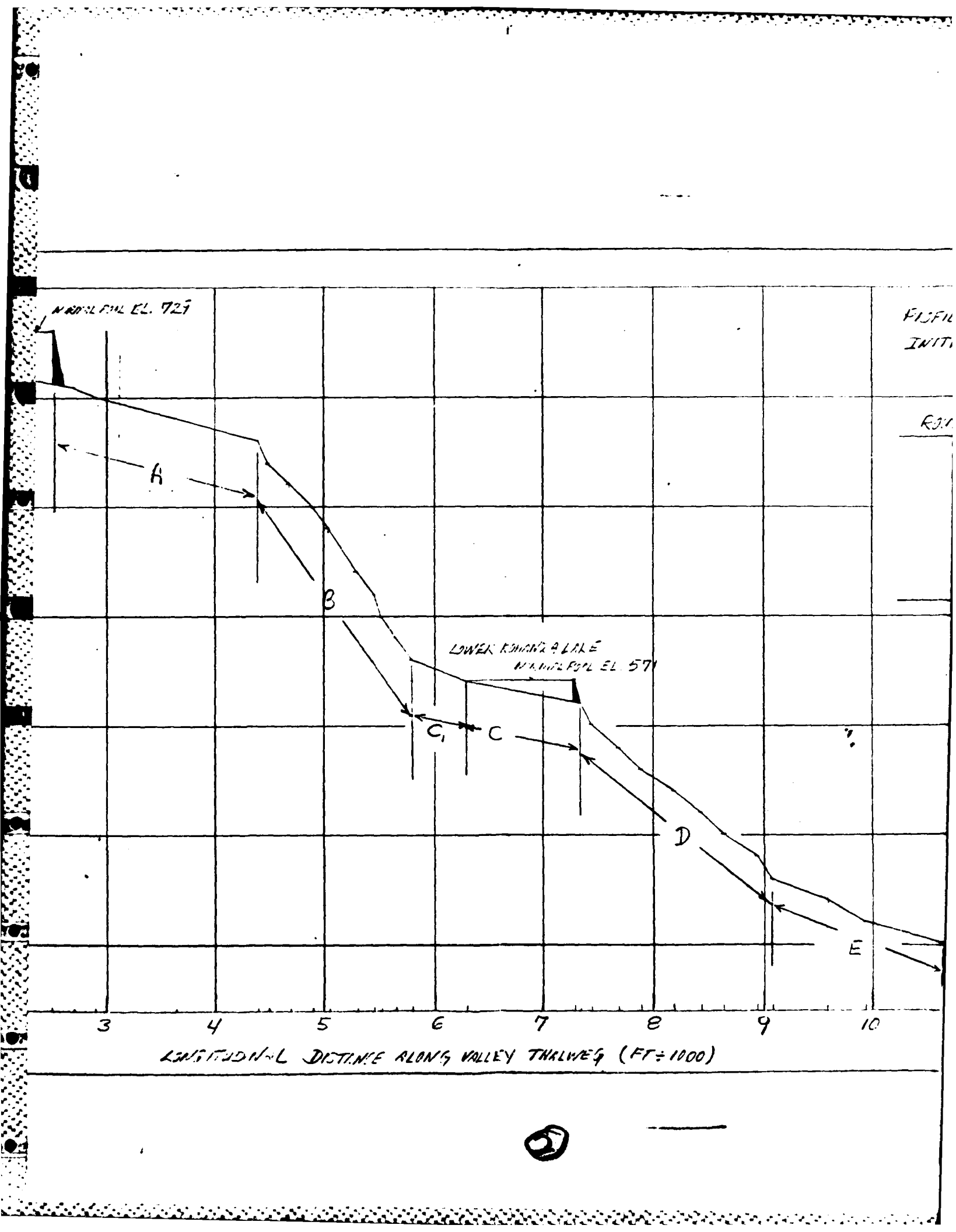
AD-A142 701 NATIONAL DAM INSPECTION PROGRAM UPPER KOHANZA DAM (CT 00062) HOUSATONIC R.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV MAY 81 2/2

UNCLASSIFIED F/G 13/13 NL



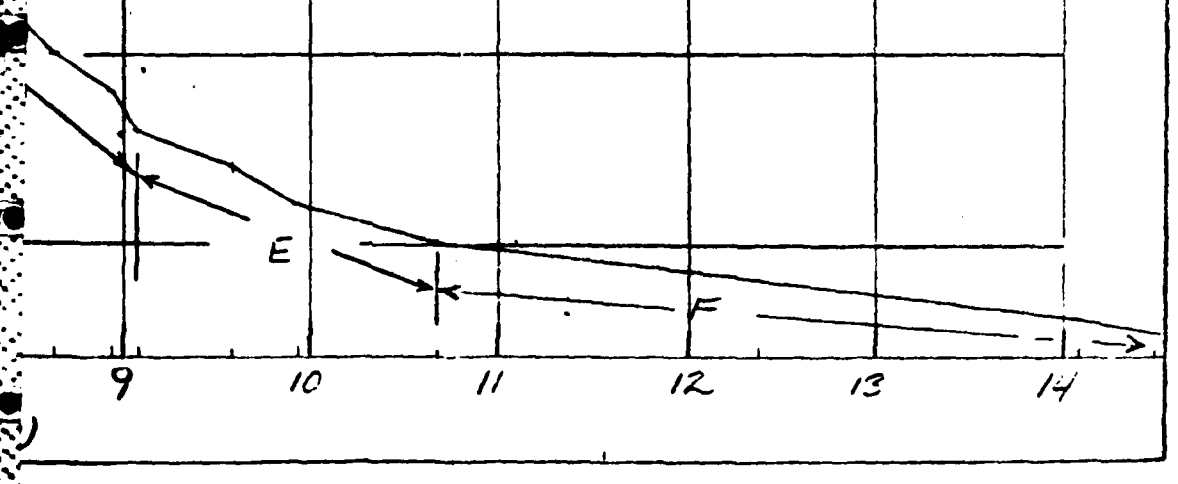
D - 20


UPPER KOMANDA LAKE
NORMAL POOL EL. 729
A
B
ELEVATION (FT NGVD)
700
650
600
550
500
450
400
0
1
2
3
4
5

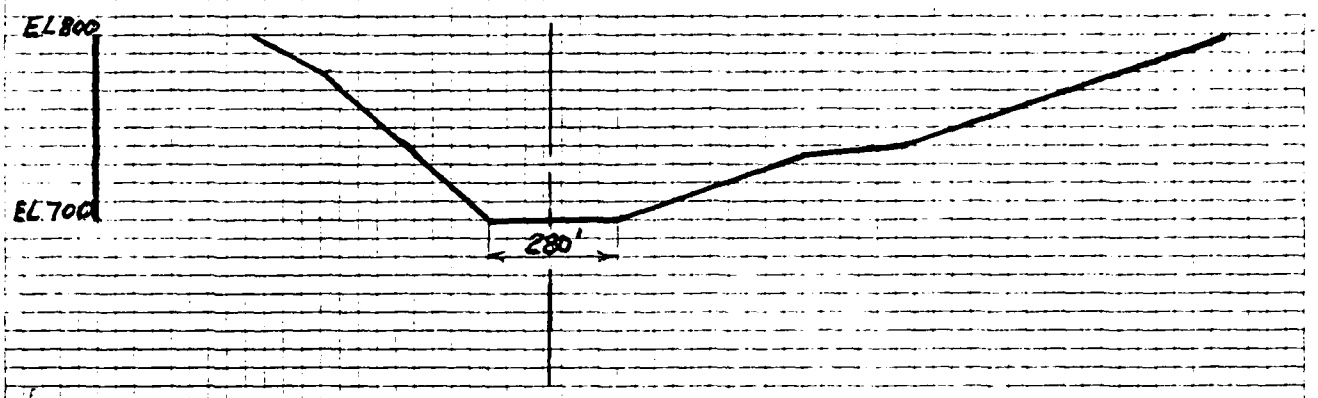

NORMAL POOL EL. 729
A
B
LOWER ROARING A LAKE
NORMAL POOL EL. 571
C1
C
D
E
3
4
5
6
7
8
9
10
LONGITUDINAL DISTANCE ALONG VALLEY THALWEG (FT÷1000)

PROFILE OF KONINZA BROOK UPSTREAM OF INITIAL IMPACT AREA

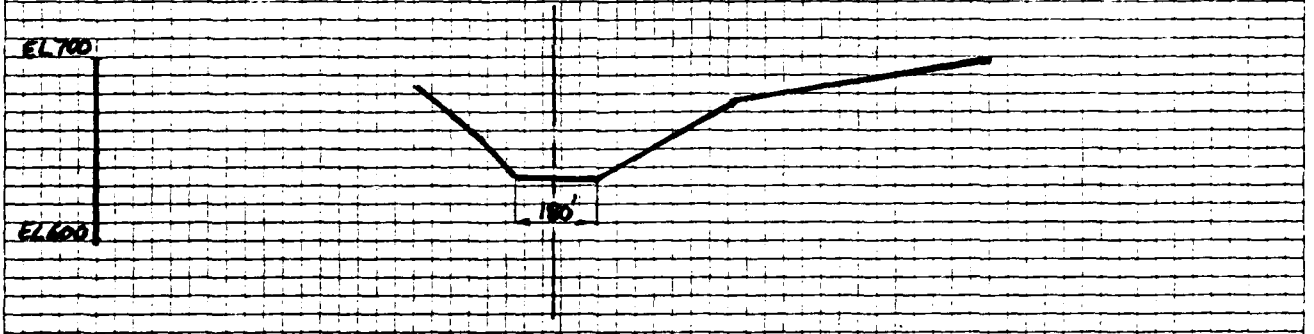
ROUTING REACH	LENGTH	AVERAGE SLOPE
A	1950	0.0142
B	1400	0.0714
C,+C	1550	0.0129
D	1750	0.0457
E	1600	0.5122
F	3200	0.0053



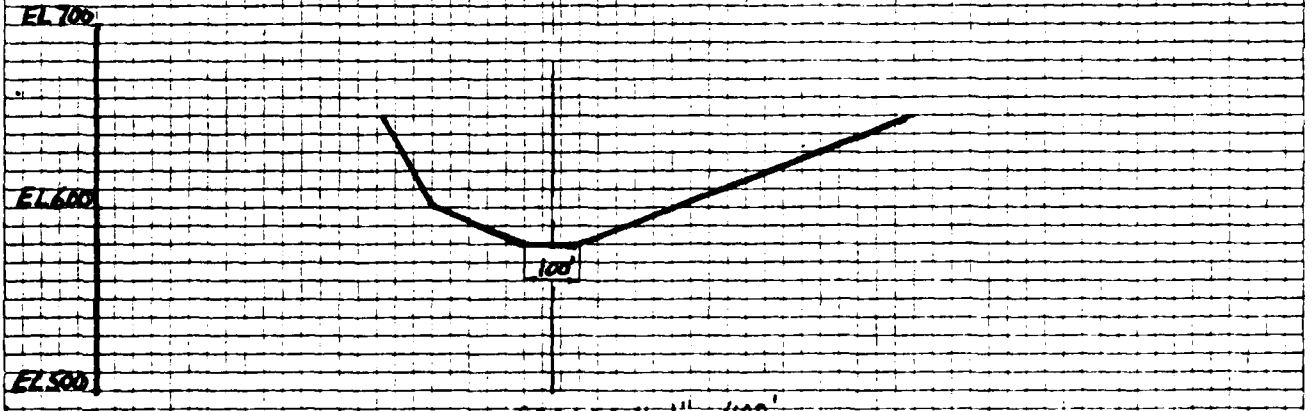
AVERAGE SECTION "A"



AVERAGE SECTION "B"

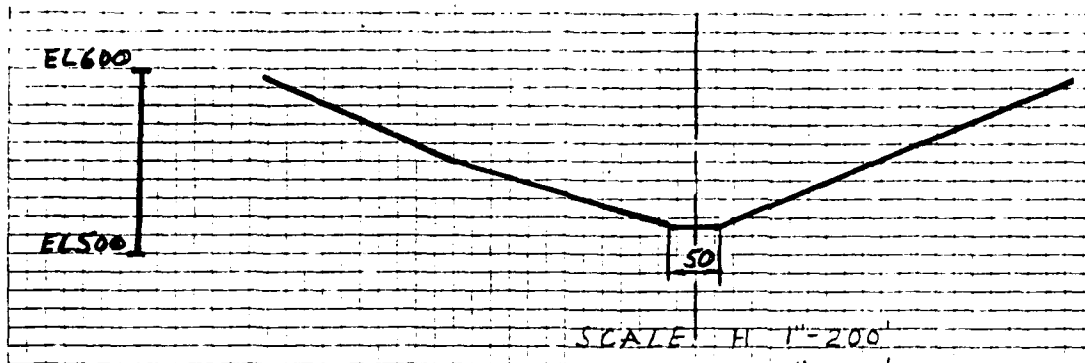


AVERAGE SECTION "C"



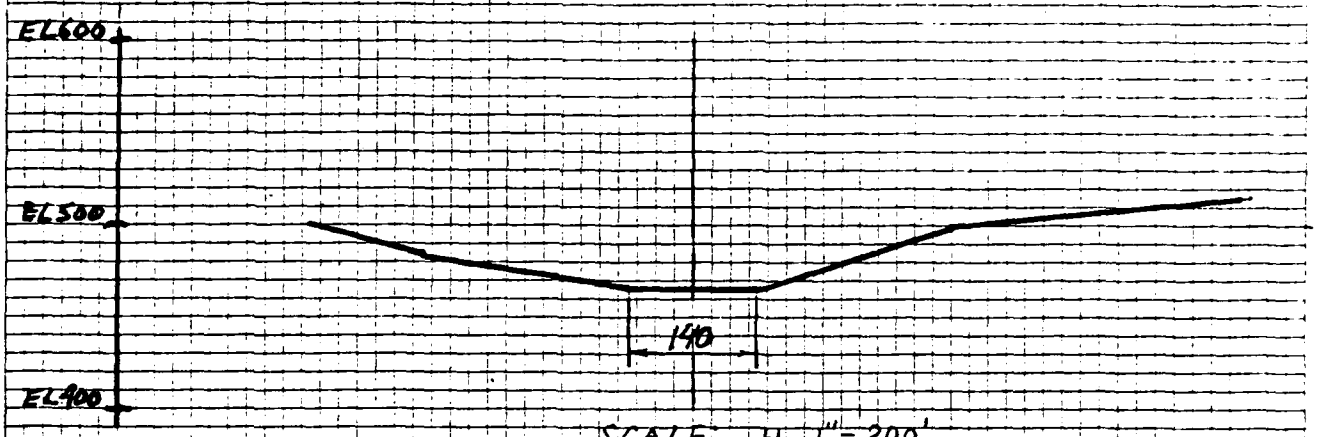
SCALE: H 1" = 400'
V 1" = 100'

AVERAGE SECTION D'



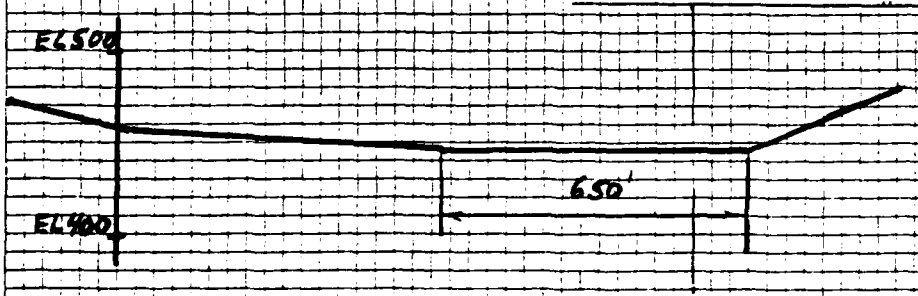
SCALE H 1"=200'
V 1"=100'

AVERAGE SECTION E'

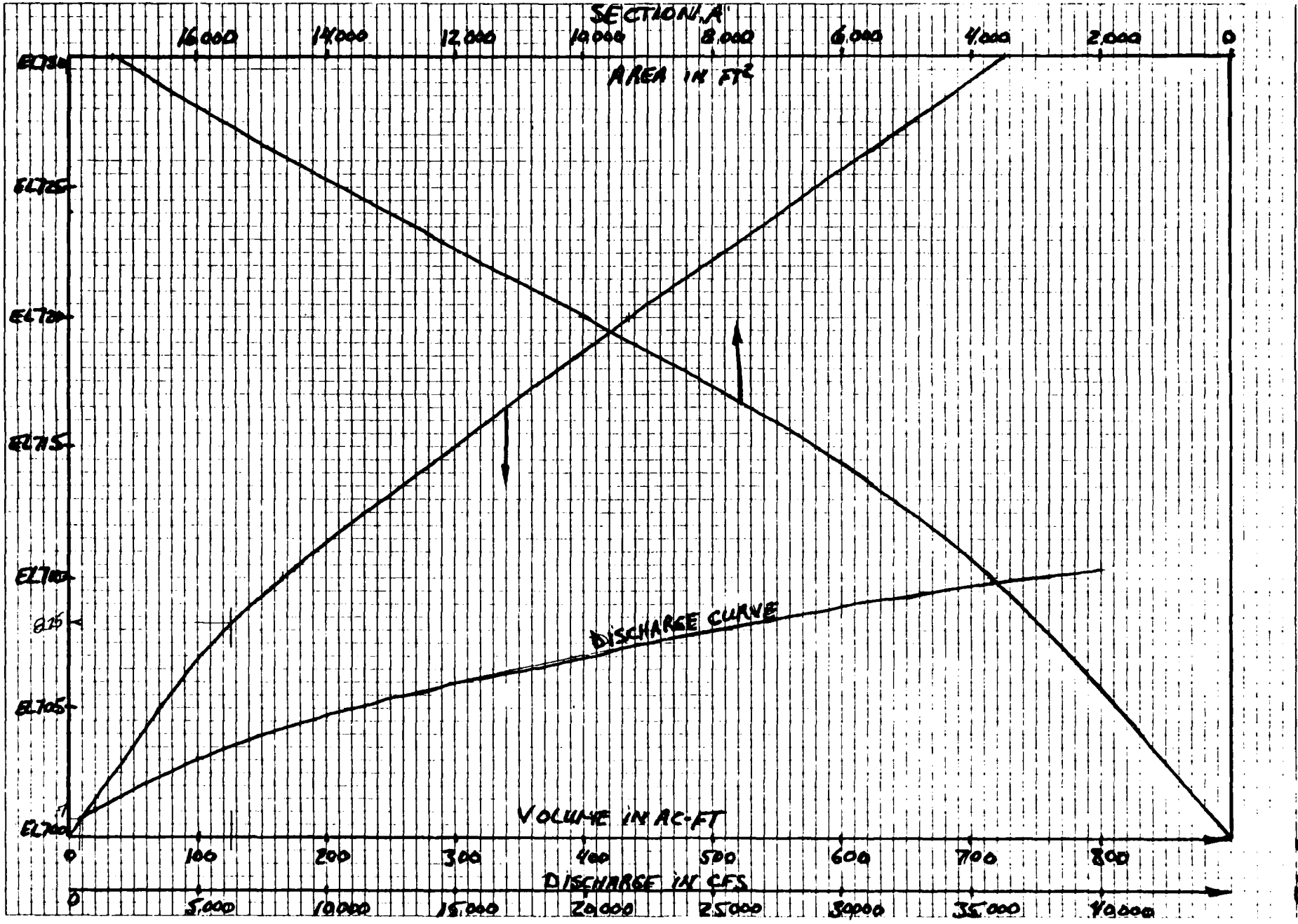


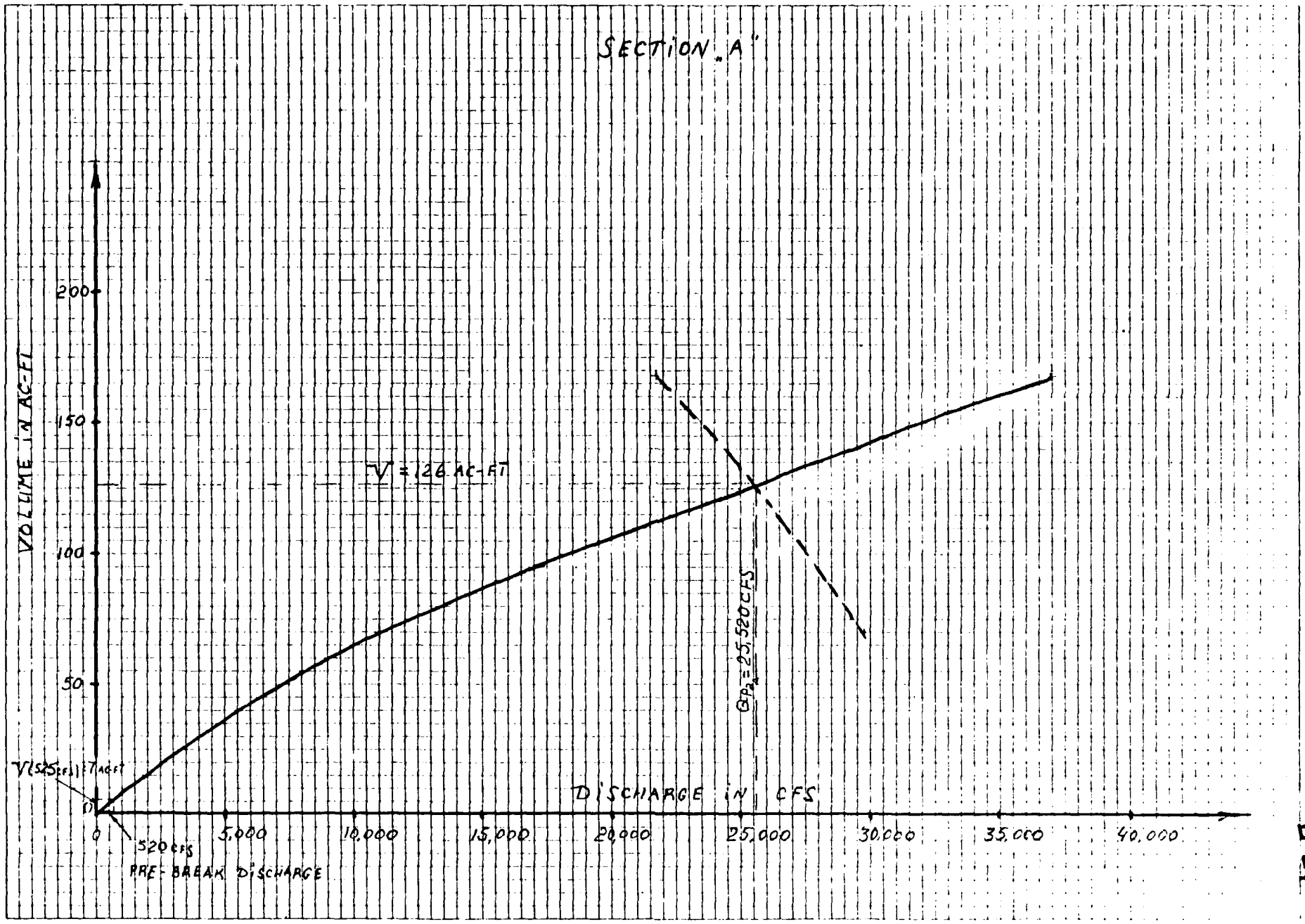
SCALE H 1"=200'
V 1"=100'

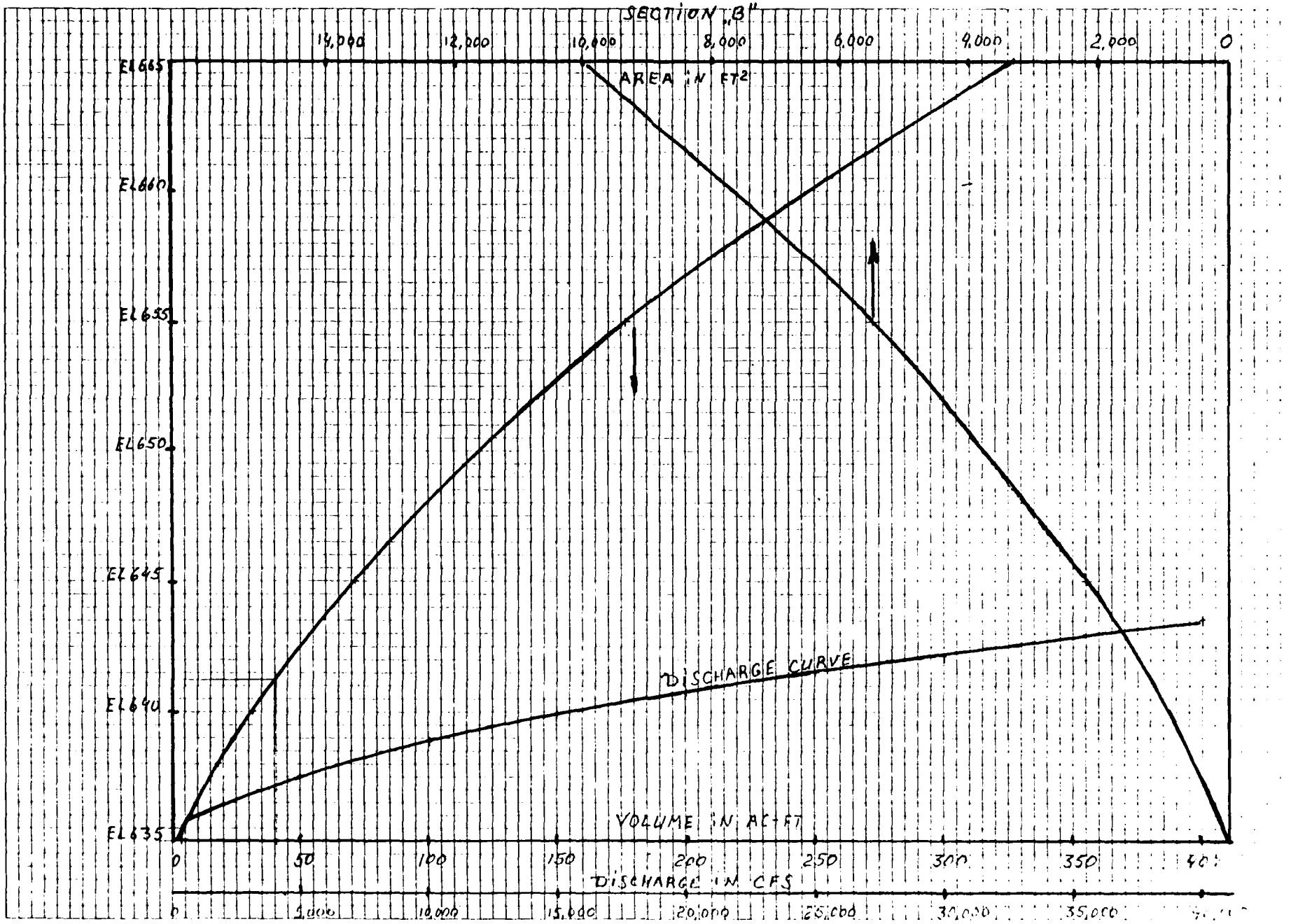
AVERAGE SECTION F'

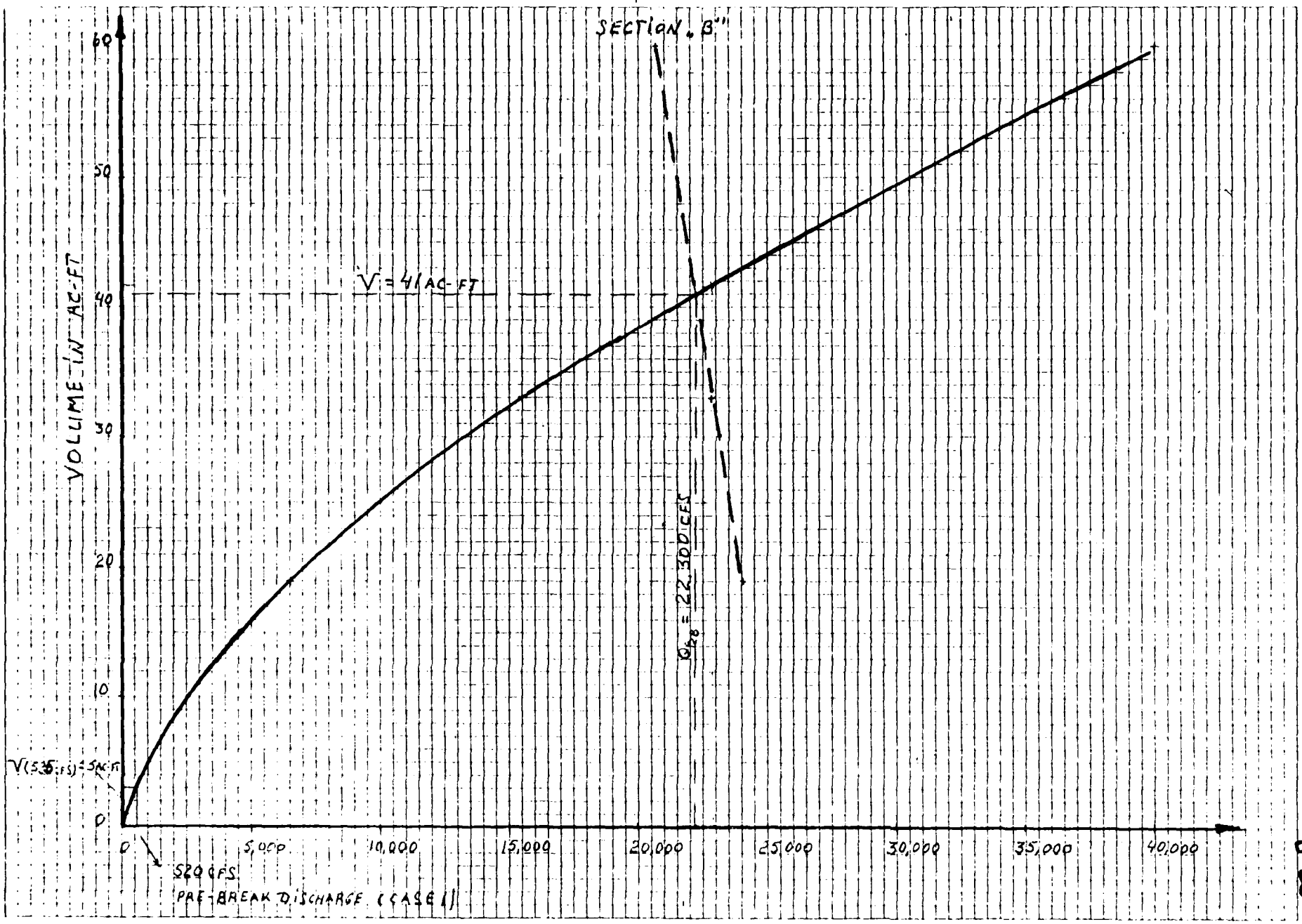


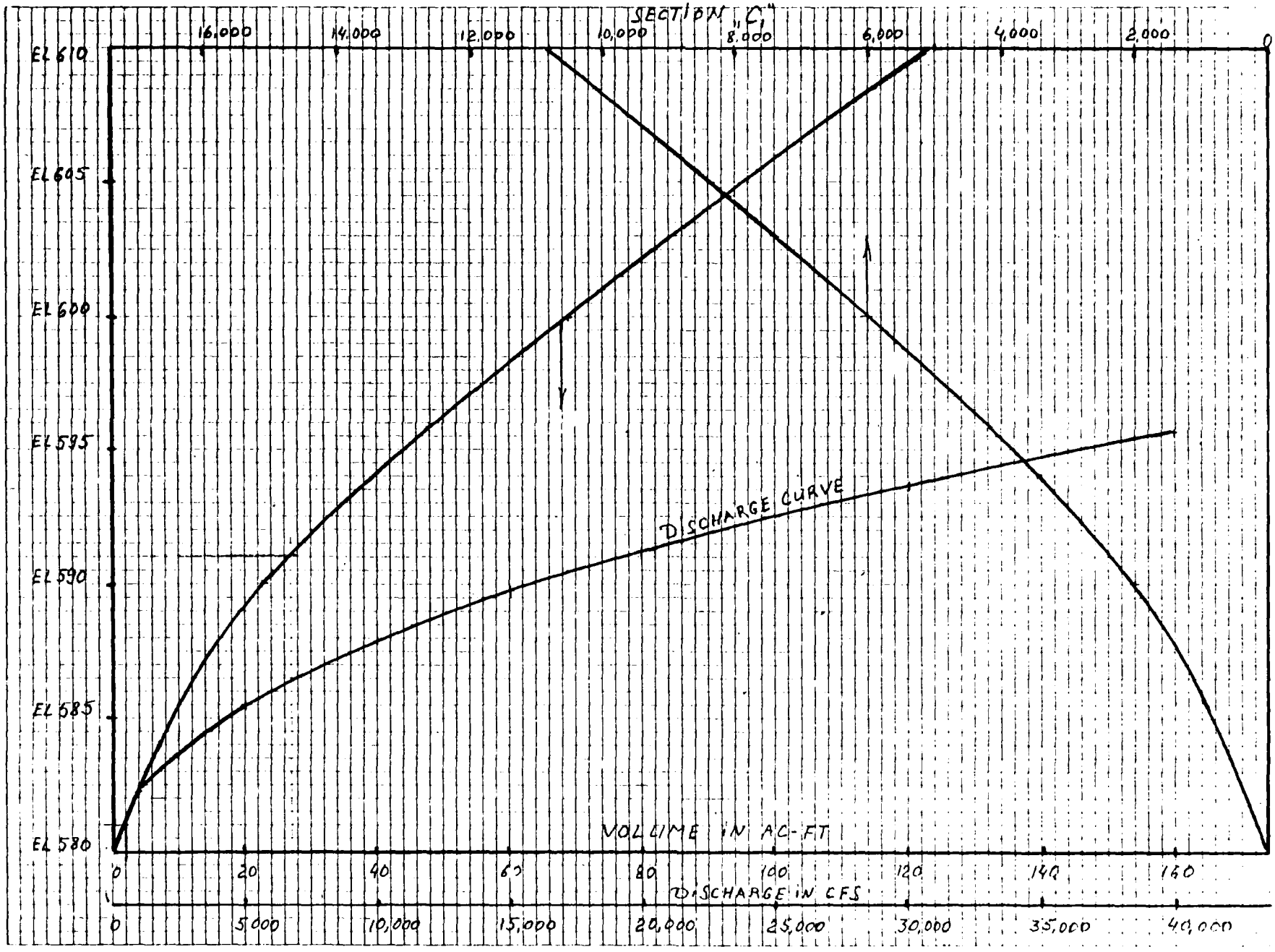
SCALE H 1"=400'
V 1"=100'



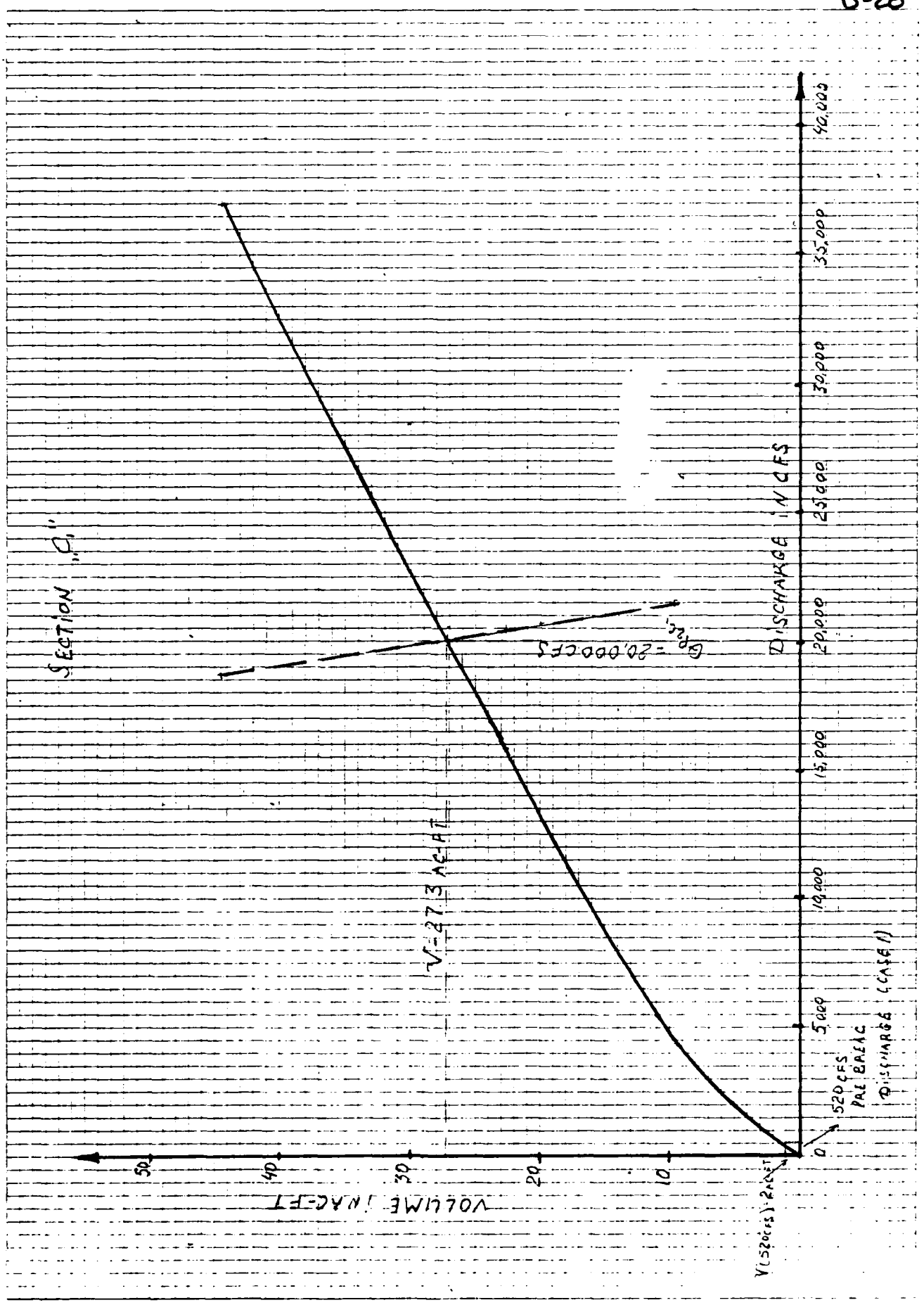





SECTION "B"
VOLUME IN AC-FT
60
50
40
30
20
10
0
V = 41 AC-FT
V(535 CFS) = 5 AC-FT
Q_{PB} = 22,300 CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
520 CFS
PRE-BREAK DISCHARGE (CASE I)


SECTION "C"
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
EL 610
EL 605
EL 600
EL 595
EL 590
EL 585
EL 580
DISCHARGE CURVE
VOLUME IN AC-FT
0
20
40
60
80
100
120
140
160
DISCHARGE IN CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000

D-28

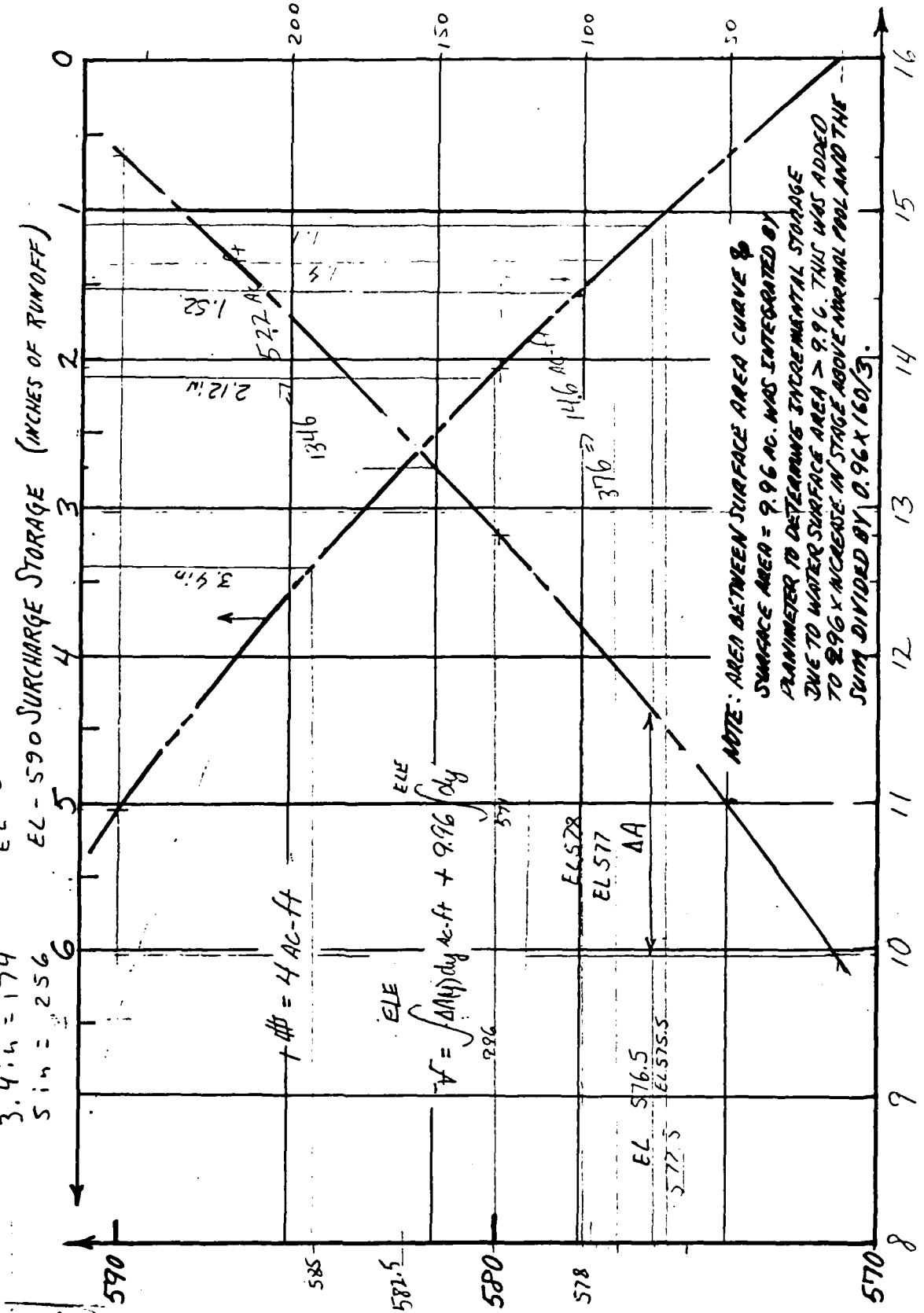

SECTION "A"
V=27.3 AC-FT
Q_{PEAK} = 20,000 CFS
VOLUME IN AC-FT
DISCHARGE IN CFS
0
10
20
30
40
50
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
520 CFS
PRE BASIC
DISCHARGE (CASE 1)

INTERNATIONAL ENGINEERING COMPANY, INC.

Project NON-FEDERAL DAM INSPECTION — Contract No. 2616 — Sheet D-29

Feature LOWER KOHANZA LAKE DAM CT 00064 — Designed RR — Date

Item STAGE-SURFACE AREA, STAGE STORAGE CURVE — Checked — Date



1,1 in = 56.3 ac-ft EL - 576.5

1,52 in = 78 ac-ft EL - 578

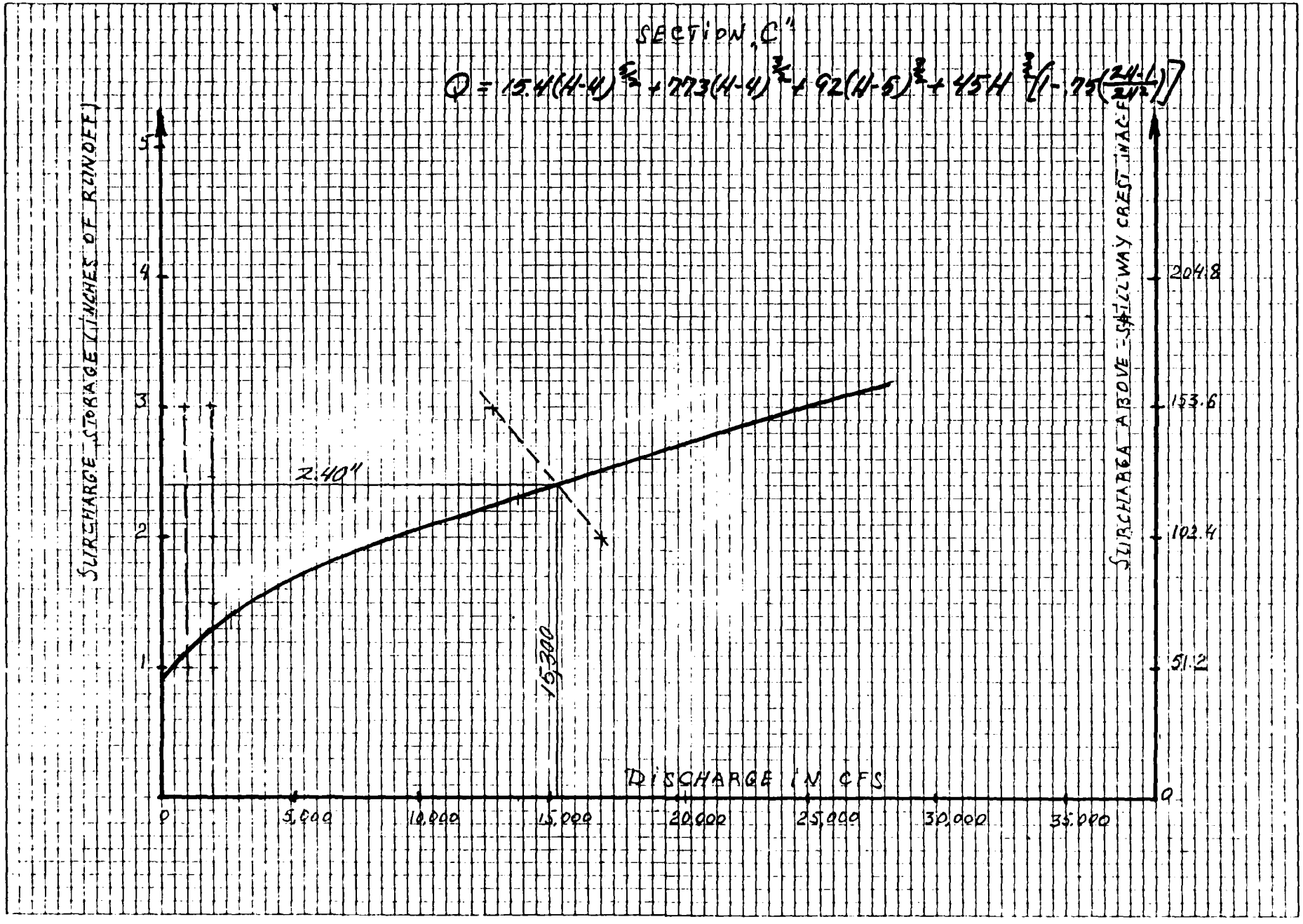
2,12 in = 108 EL - 580

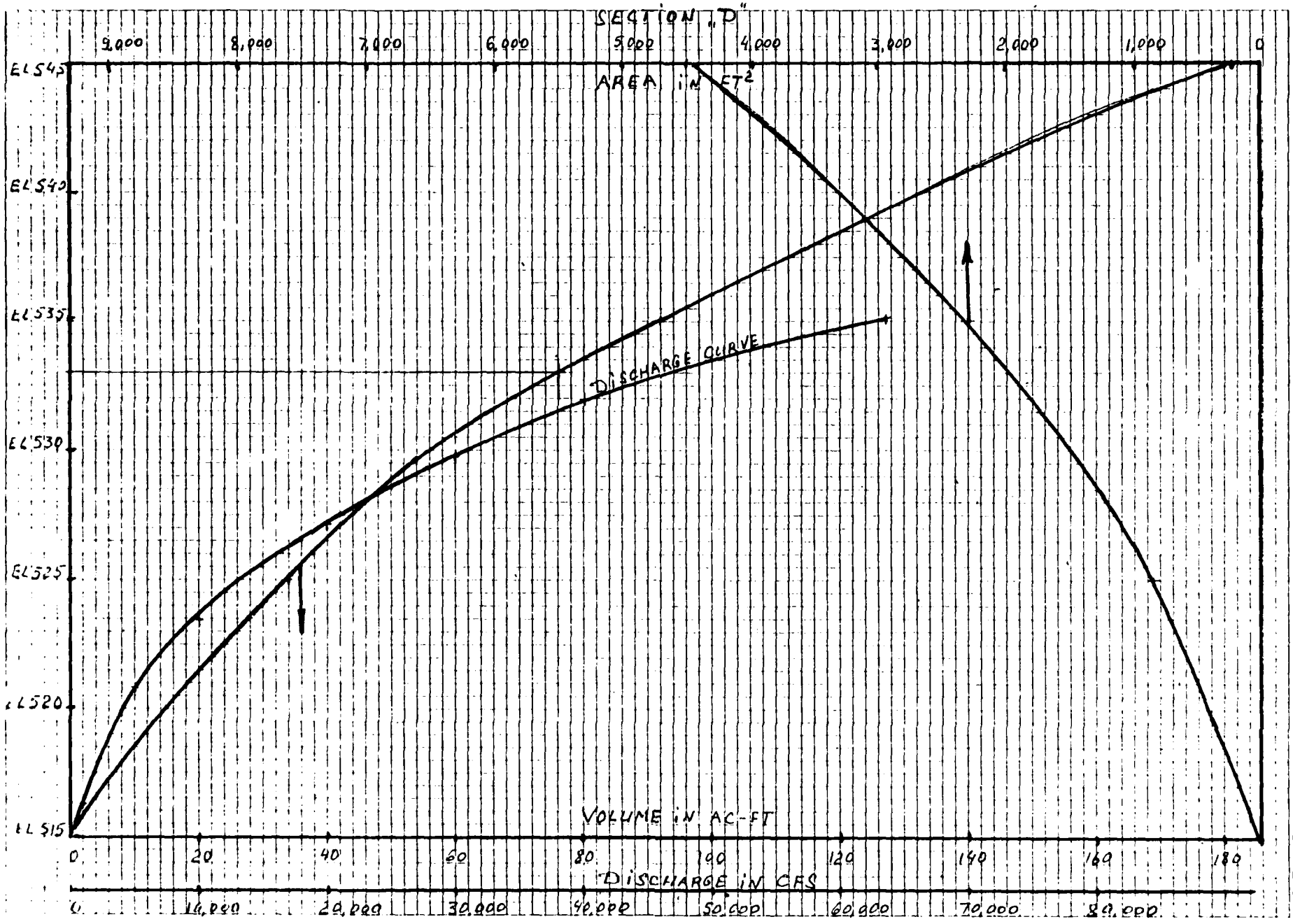
3,4 in = 174 EL - 585

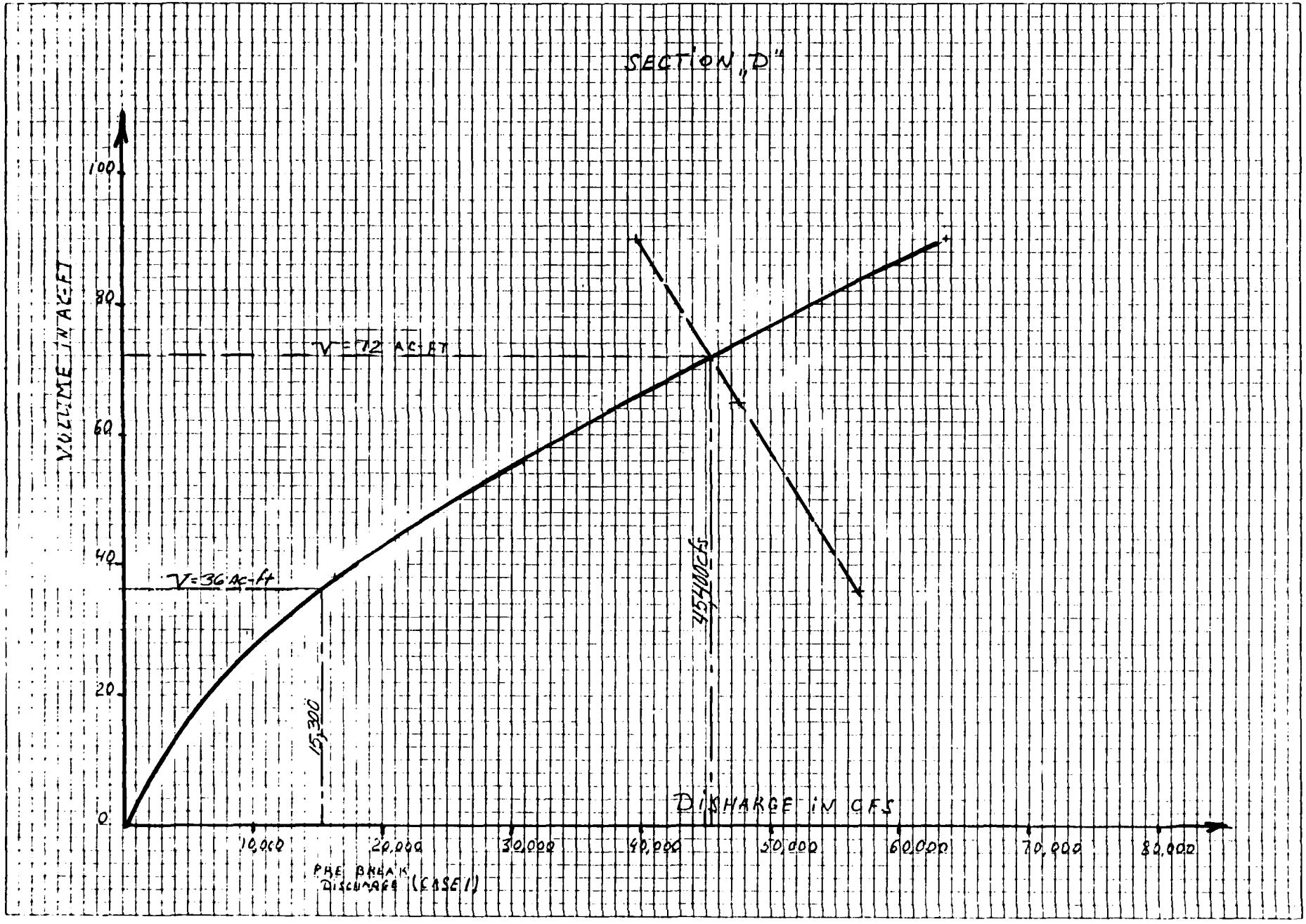
5 in = 256

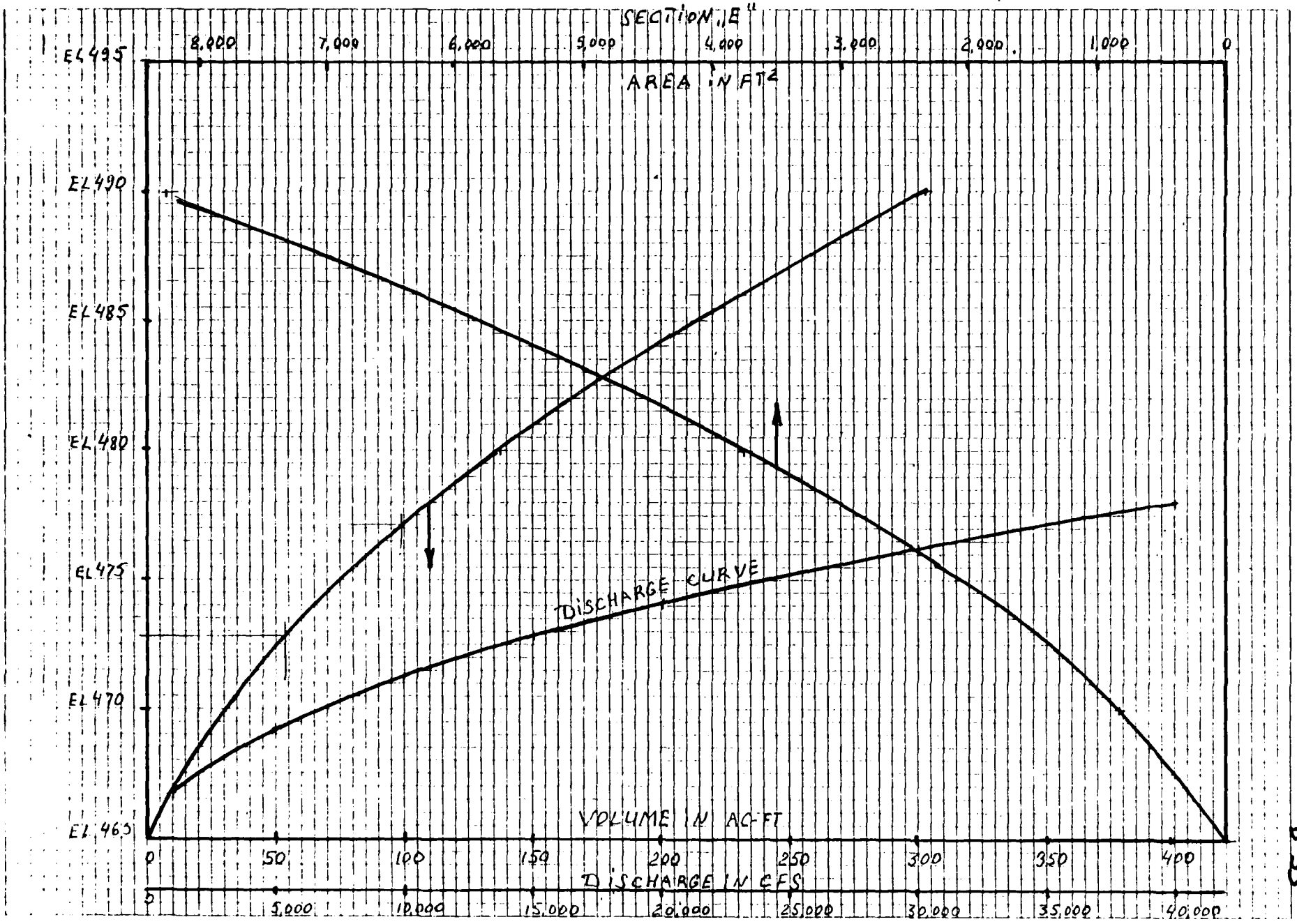
$$A = \int_{ELE}^{ELE} \Delta A(H)\,dy \text{ ac-ft} + 9.96 \int_{576}^{579} dy$$

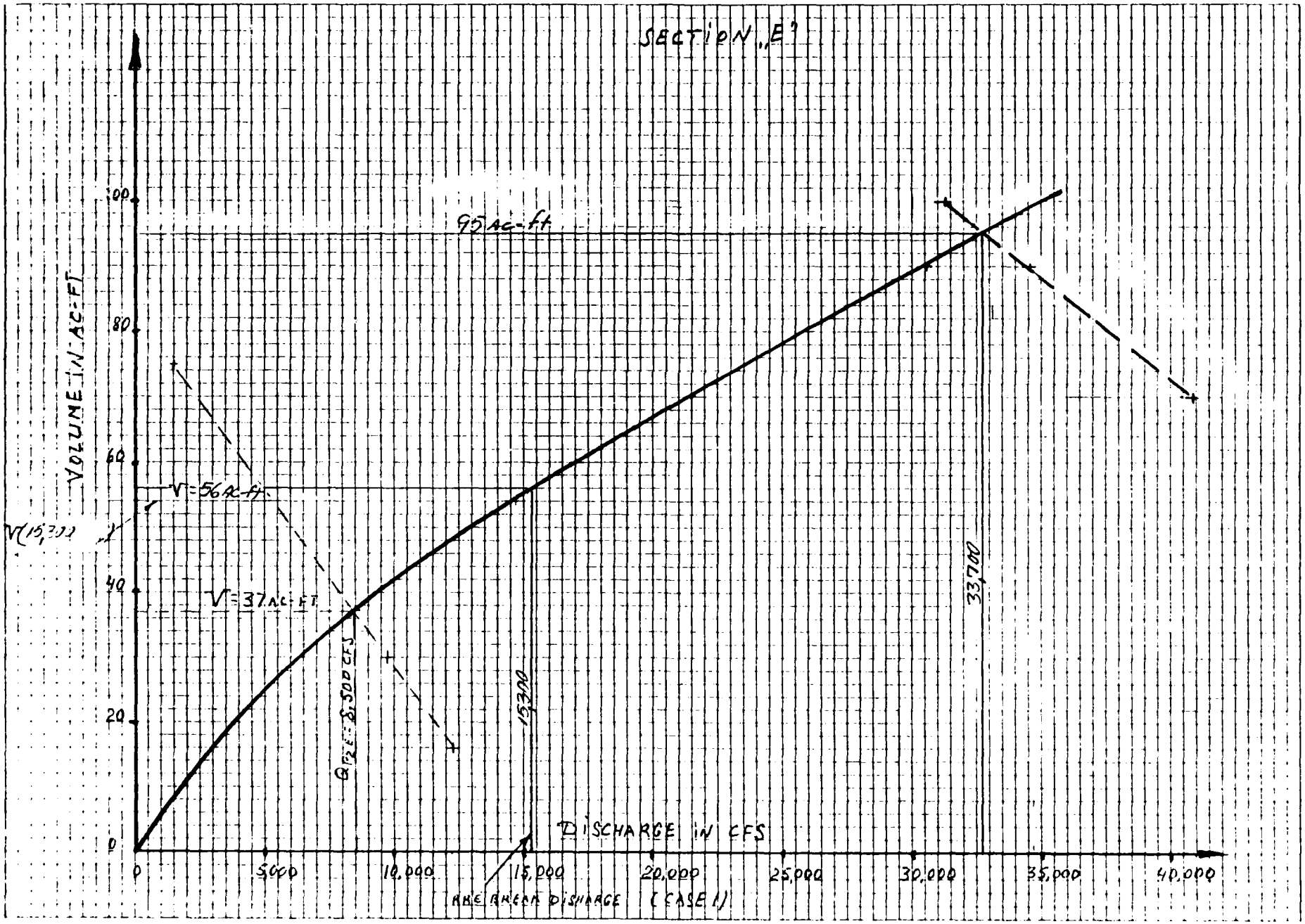
24 reads

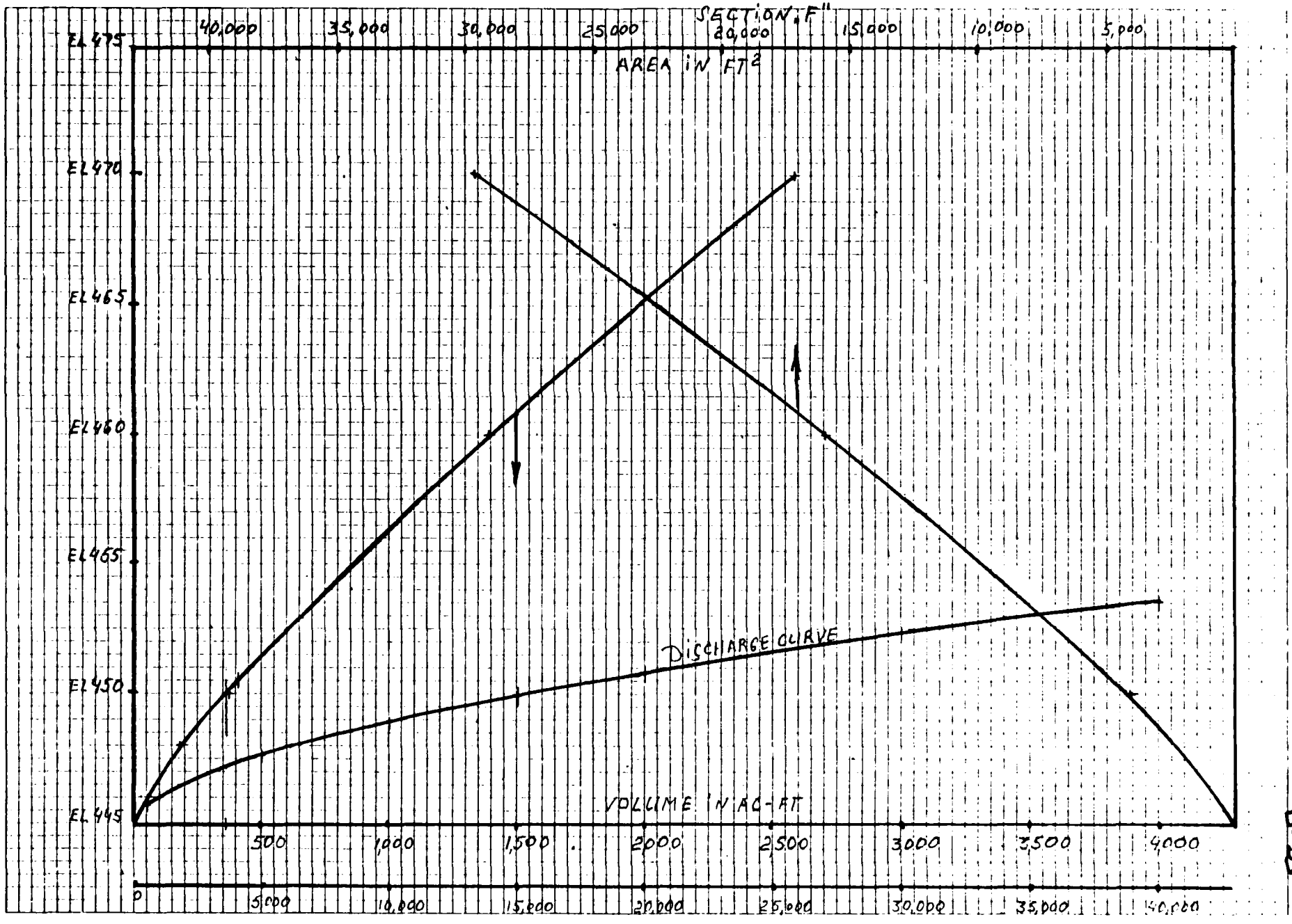

SECTION "C"
$Q = 15.4(H-4)^{\frac{3}{2}} + 77.3(H-4)^{\frac{3}{2}} + 92(H-5)^{\frac{3}{2}} + 45H^{\frac{3}{2}}\left[1 - .75\left(\frac{24-L}{24+L}\right)\right]$
SURCHARGE STORAGE (INCHES OF RUNOFF)
SURCHARGE ABOVE SPILLWAY CREST IN ACRE-FEET
DISCHARGE IN CFS
2.40"
15,300
0
1
2
3
4
5
204.8
153.6
102.4
51.2
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000

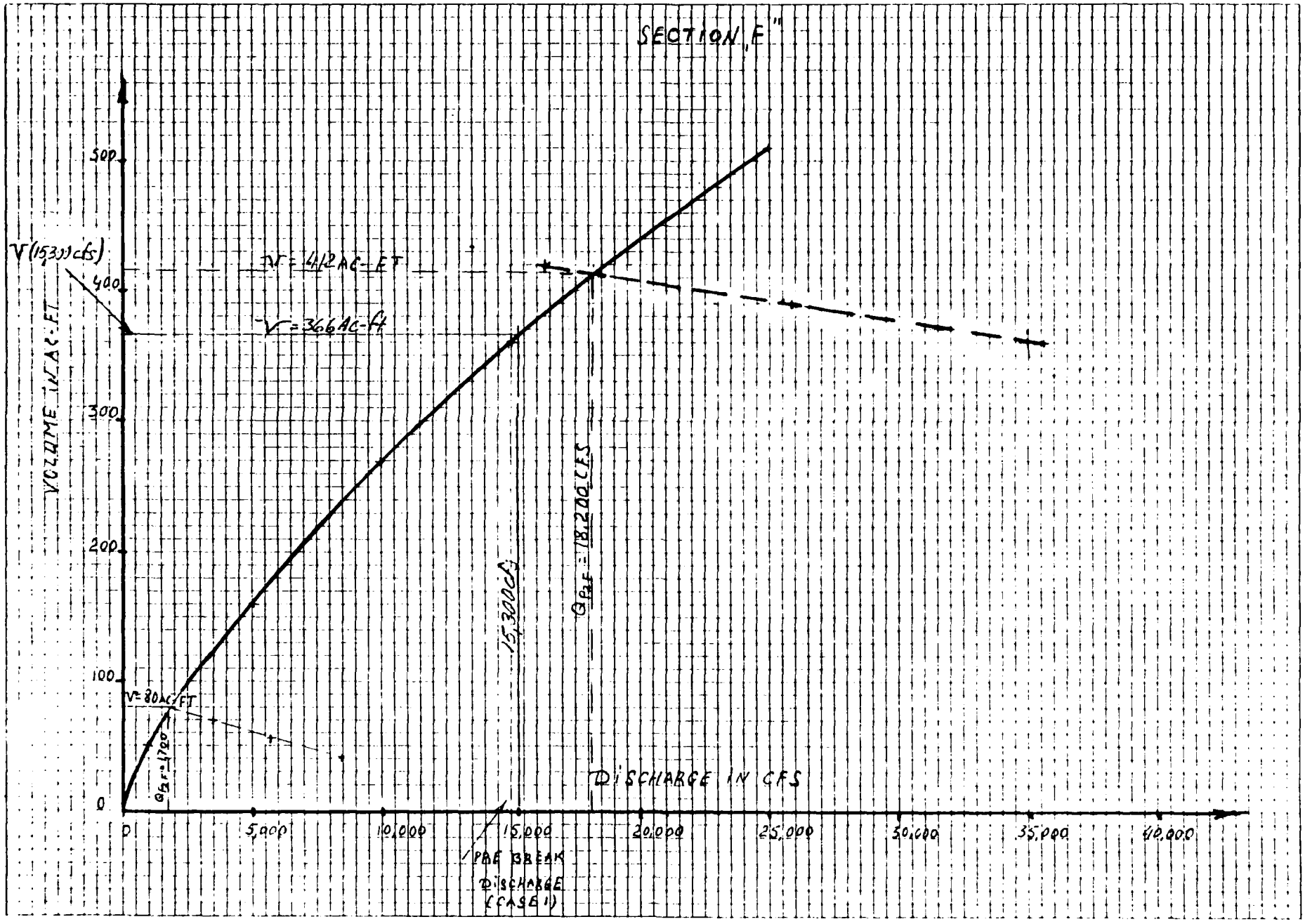





SECTION "E"
AREA IN FT²
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
EL 495
EL 490
EL 485
EL 480
EL 475
EL 470
EL 465
DISCHARGE CURVE
VOLUME IN AC-FT
0
50
100
150
200
250
300
350
400
DISCHARGE IN CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000






SECTION F"
V(1533) cfs
VOLUME IN AC-FT
500
400
300
200
100
0
V = 442 AC-FT
V = 366 AC-ft
V = 80 AC-FT
Qpf = 1720
15,300 CFS
Qpf = 18,200 CFS
DISCHARGE IN CFS
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
PBF BREAK
DISCHARGE
(CASE II)

APPENDIX E

INFORMATION AS CONTAINED IN THE

NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTIFICATION NUMBER	INVENTION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
CT	[illegible]	[illegible]	CT	001	05				UPPER KOHANZA DAM	4125.9	7324.4			

POPULAR NAME	NAME OF IMPOUNDMENT
	UPPER KOHANZA LAKE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	10	KOHANZA BROOK	DANBURY	1	50781

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RE	1866	S	31	31	420	206	NED	N	N	N	N	

REMARKS
22-ESTIMATE 25 LOCATION OF FOUNDATION BOTTOM UNKNOWN

D/S HAS	SPILLWAY LENGTH (FT.)	SPILLWAY TYP	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (CFS)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	624	U	12	525	65000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF DANBURY	UNKNOWN	UNKNOWN

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	CT DEP	CT DEP

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
INTERNATIONAL ENGINEERING CO INC	03	FEB	1	PL 92-367

REMARKS
34-ESTIMATE

END

FILMED

8

DTIC